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Tree Pest Management: A Field Report

ISSN 0043-1753

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WT&T

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WT&T OUTLOOK

The more we try to gauge trends in the economy the more we realize how unpredictable our complex economy is. It is complexity that is preventing severe problems currently.

That is not to say many are not being severely hurt by conditions at present. Hundreds of thousands of auto workers will tell you that. But the Green Industries may get just a light shower rather than a monsoon.

Nonresidential construction contracts are holding their own so far. Architects are keeping busy and even expanding in the Sun Belt. Nonresidential landscape construction will benefit from winter contracts for a year or more. Highway construction has received a helping hand by a recent surge in Federal dollars. Erosion control and highway maintenance contractors will get a boost eventually from this news.

The maintenance contractor faces the toughest challenge with fertilizer prices jumping 15 to 20 percent, gasoline prices likely to rise another 30 percent, and similar price hikes for other petrochemicals and supplies. A recent survey by ALCA provides additional cause for concern because the average profit of landscape contractors was 4.24 percent. There is not much fat to work with. ALCA also reports average liabilities of $321,000 on assets of $520,000, $171,000 of these fixed assets. Capital averaged $197,000.

It is critical that everyone in the Green Industry get a handle on his books. Taking jobs for a loss just to get cash flow or to showoff may be a fatal mistake in a tight year such as this. Jobs should be priced individually, carefully, and with all overhead considered.

Business consultant Warren Purdy gave an excellent talk on costs at the ALCA show last month. I'd recommend that local associations arrange financial management seminars as soon as possible to help their members keep dry in 1980.

WT&T LETTERS

On the front cover of the December issue the caption for the tree illustrated was Buckeye or Horse Chestnut. These two are as different as the silver and sugar maples. The Ohio buckeye (*Aesculus glabra*) has smaller greenish yellow upright panicle six-in. high flowers, is more roundheaded and broader, five leaflets and palmately compound, colors up a good orange in autumn and the winter terminal buds are clean.

Whereas the horse chestnut (*Aesculus hippocastanum*) usually has seven leaflets also palmately compound, poor fall color, very susceptible to leaf scorch, more upright, very sticky buds in winter and whitish flowers with red and yellow throated 10- to 12-in. flower clusters.

Dr. L.C. Chadwick, Professor Emeritus of Horticulture at Ohio State University, is very emphatic in the differentiation of these two species.

Dick Sebian, Grounds Construction Foreman
S.U.N.Y. Buffalo, NY

Thank you for your correction. The fact that one is considerably more susceptible to leaf scorch is worth the attention of anyone who specifies trees for low maintenance landscapes. By the way, Dr. Chadwick has been writing Doug Chapman regularly on Doug's tree selection series. He still is emphatic on differentiation of trees according to hardiness, disease resistance, and proper use of trees in landscapes.

Why isn't there more emphasis placed on certification of landscaper skills? It is now being done in the automotive industry to weed out the schlock work.

K.S., Germantown, MD

Your point is well taken by the executives of both the Professional Grounds Management Society and the Associated Landscape Contractors who are viewing such programs. There has been some resistance to certification in certain states due to ineffectiveness by government agencies and their enforcement. The association method of certification seems to be preferred. PGMS has just begun accepting application for certification. Interested persons should contact PGMS, Allen Shulder, 19 Hawthorne Ave., Pikesville, MD 21208, 301-653-2742.

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GREEN INDUSTRY NEWS

ALCA growth evident at annual meeting

The growth in membership and market diversity of the Associated Landscape Contractors of America was clearly evident during ALCA's annual meeting in San Diego in February.

More than 750 contractors attended, a dramatic increase in attendence from the 1979 show. More than 40 exhibitors had booths. An equipment demonstration in a field next to the Town and Country Hotel provided an effective and dramatic display of tractors, trenchers, trimming equipment and hydraulic mulching and seeding machinery.

Perhaps the most noticeable difference in educational sessions was the presence of many interiorscape contractors and designers which also meant a greater percentage of women delegates. This group of specialized contractors listened intently to all business sessions.

Design/Build received the greatest attendance of all the educational sessions. Interiorscaping was next in popularity.

The location of the show attracted a large number of family members. It may have also provided competition for some of the sessions which had surprisingly low attendance even though the subjects were recommended by ALCA members themselves.

Concurrent sessions, as many as four at once, gave delegates a wide choice of topics. To show the diversity of topics covered, these are some of the specific market areas covered: design/build, interiorscaping, erosion control, irrigation, maintenance, lawn care, and basic contracting.

In addition to these there were sessions on communications, and bidding and costing. The sessions began with the keynote presentation by Mike Vance on Creative Thinking.

Sixty-four landscape projects, including three outside the United States, were honored during the Environmental Improvement Award ceremonies at the meeting. There were 11 grand awards, 17 merit awards and 33 awards of distinction. Included in the awards were two from the United Kingdom, one from Saudi Arabia, and nine for interiorscape projects.

Grand Award winners included:

Residential - Parson and Wewerka

Continues on page 12

An early morning fog burned off in time for a whole morning of equipment demonstrations next to the convention center.

Vegetation Problems?

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"I have a good buddy at another tractor dealership but I still bought a John Deere. I hope he forgives me."

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When Clifton Clause and Burt Ortego started out in the construction business, the first thing they needed was a tractor.

They looked over several different brands. Compared them all for size, weight, horsepower, features and, of course, price.

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Of course, like all John Deere tractors, 'little-big' tractors are built to take a lot of hard use.

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The little-big tractors from John Deere

LANDSCAPE CONTRACTOR NEWS

LAF terminates management by consultants

The Executive Board of the Landscape Architecture Foundation decided in December to terminate the foundation's management contract with Executive Consultants of McLean, VA. Executive Consultants at one time managed the Associated Landscape Contractors of America, the American Society of Landscape Architects, and the Landscape Architect Foundation. LAF is the last to break away from the management consultant group in an effort to increase productivity and service.

Nursery promotion expected to boost sales by five percent

Nursery related industries can expect to experience a five percent increase in sales in areas where advertising by the Nursery Marketing Council runs. NMC made this prediction based upon consumer research tests using radio advertising to promote beauty and value enhancement of living plants.

A scatter plan will be used to place advertising until NMC can generate the $2.75 million estimated for a national program. NMC has a goal to advertise nationally, seven days per week a solid three months in the spring.

Funds for the advertising come from nursery suppliers who contribute 1/4 percent of invoice totals. Interested persons should contact NMC, 230 Southern Bldg., Washington, D.C. 20005.

Inc., of Woodbridge, VA and Schlick Landscaping Inc, Huntington, NY.

Commercial - Century Landscape Contractors, Agoura, CA with two project awards.

Design-build - Landscape Associates Inc., Little Rock, AR and Theodore Brickman Co., Long Grove, IL

Maintenance - Ladybug Industries Inc., Jacksonville, FL, Ray's Landscape and Nursery Inc., Walled Lake, MI, and Clearwater Landscaping Co., Sun Valley, ID

Interiorscape Installation - North Haven Gardens Inc., Dallas, TX

Interiorscape Maintenance - Cohlmia's, Tulsa, OK

Some of the winners will be featured in Weeds Trees & Turf later in the year in a roundup of the best landscape designs for 1980.

New officers were installed during the meeting. They include President Wallace SaBell of Denver, President-Elect Allen Keesen of Denver, Vice-President Ritchie Skelton of Vienna, OH, Vice-President Ray Gustin III of Gaithersburg, MD, Treasurer David Pinkus of Dallas, and Secretary Landon Reeve of Woodbine, MD.

ALCA also presented safety awards to 12 landscape contracting firms at the show, during a special breakfast meeting. The awards were made according to the number and time lost as reported for the period September 1978 through August 1979. Three firms reported no accidents or time lost.

If San Diego wasn't nice enough, a group of ALCA members continued the meeting on a three-island tour of Hawaii.

SALES

Echo ups sales for seventh year in a row

Echo, Inc. of Northbrook, IL, expects to report increases of 45 percent for the fiscal year just ended, an increase that represents a seventh consecutive record sales year for the company.

Echo markets a variety of two-cycle engines but has become well-known for its outdoor power equipment, including chain saws, power blowers, hedge trimmers, and weed and grass trimmers. Its chain saw line was up in volume more than 30 percent last year.

HORTICULTURE

Lower temperatures save greenhouse heat

Researchers at the Connecticut Agricultural Experiment Station in New Haven have shown that plants can tolerate lowered temperatures in a greenhouse for part of the night, thereby saving fuel.

They indicate that fuel consumption in a greenhouse can be reduced by about 20 percent from January to April. The savings in dollars for growers can be significant because fuel accounts for half the cost of growing plants in greenhouses in the Northeast.

The fuel savings occur if the temperature in the greenhouse is maintained at 60 degrees F for the first part of the night, which is the standard practice, and then allowed to drop to 45 degrees for eight hours.

GRANTS

HRI expands its research grant program

The Horticultural Research Institute has announced the funding of five $1,000 research grants in addition to 15 Richard P. White $500 research grants for the coming year 1980. The grants will be awarded to help researchers conduct important projects of direct interest to the nursery and landscape industries.

Any organization conducting research which may benefit the nursery community—state and federal research laboratories, land grant universities, forest research stations, business firms, botanical gardens, and arboreta—is invited to make application for one of the grants.

An advisory committee of research scientists reviews applicants and selects them on the basis of information from a simple questionnaire.

Grants are available from the HRI, 230 Southern Building, Washington, DC 20005, and must be returned by May 1, 1980. The grants will be awarded in November.

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The strongest Dutch elm disease protection you can give a tree.

ARBOTECT 20-S fungicide helps make it possible to save many elm trees that otherwise would be lost.

Injected into the trunk of the tree, ARBOTECT builds a barrier against Dutch elm disease inside the tree itself. It helps prevent the disease in healthy elms, and can often save infected trees if they are treated early enough.

Used along with sanitation, insect control, and root graft elimination, ARBOTECT can significantly improve the effectiveness of a Dutch elm disease control program.

ARBOTECT differs from other elm fungicides in several important ways:

- It is registered at rates high enough to be effective.
- It is concentrated, requiring much less water for injection, so trees can be treated much faster.
- Thiabendazole, the unique active ingredient in ARBOTECT, is highly effective against *Ceratocystis ulmi,* the fungus that causes Dutch elm disease.
- Even though it is more effective and convenient, ARBOTECT costs about the same to use as other elm fungicides.

This year, put ARBOTECT to work in your disease control program. It's the strongest protection you can give an elm against Dutch elm disease.

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GOVERNMENT UPDATE

Revisions for Davis-Bacon

Major changes have been proposed in regulations issued under the Service Contract and Davis-Bacon Acts, in order to clarify and strengthen both laws, says Secretary of Labor Ray Marshall.

The Service Contract Act generally applies to any contract with the Federal government which is principally for the furnishing of services. Under the act, contractors and subcontractors are required to pay their employees, working on contracts in excess of $2,500, monetary wages and fringe benefits determined by the Secretary of Labor in a locality and also observe safe, sanitary working conditions.

The proposed changes would revise, update, and clarify the Regulation 29 CFR Part 4 so that contracting agencies, contractors, and employees can be made fully aware of their responsibilities and rights.

The Davis-Bacon and related acts require the payment of prevailing wages and fringe benefits to employees of contractors and subcontractors performing on federally financed or assisted construction projects.

Proposed changes in 29 CFR Part 5 contain substantial revisions to the labor standards clauses which contracting agencies are required to include in their construction contracts. The major changes would affect procedures for:

—adding classifications and rates not listed in the wage determinations;

—the resolution of labor standards disputes;

—the withholding of contract funds for wage underpayments; and

—the debarment of contractors and subcontractors.

Certain changes have also been proposed to reduce the volume of enforcement reports exchanged between the contracting agencies and the department.

Act would provide water incentives

Congressman Norm Shumway, 14th District, California, has introduced the Irrigation Water Conservation Act of 1979 (H.R. 5965) which would provide incentives for conversion to efficient, water-conserving farm irrigation systems.

To provide the incentive for such conversions, Shumway's bill would permit an additional 10 percent investment tax credit for the use of such water conserving irrigation systems as drip irrigation, sprinkler systems, canal or ditch linings, pipeline equipment, or recovery systems. "Growers who use such equipment would also be able to depreciate that property over three years, thus receiving double encouragement to make the costly change," Shumway stated.

Pointing out that his legislation will benefit more than agriculture, Shumway said, " More water would be available for municipal use, groundwater recharge, and the enhancement of fisheries. Energy savings can be expected due to reduced irrigation pumping demands."

Interior approves reclamation plan

Assistant Secretary of the Interior Joan M. Davenport has approved a mining and land reclamation plan for CF&I Steel Corp.'s proposed underground coal operation on two Federal leases near Bokoshe, OK.

The mine plan was accepted with the stipulations that CF&I continuously evaluate the feasibility of recovering all or parts of the upper Harshorne coal seam and that the company protect the habitat of a chestnut-type tree that is being proposed for protection under the Endangered Species Act.

Under the mine plan, CF&I would use existing surface facilities to process the coal and would assume all land reclamation responsibilities when Garland Coal Mining Co. completes its surface operations in 1982, including a reclamation bond amounting to about $18,000 per acre.

PUBLICATION

Text on aquatic toxicology released

Aquatic Toxicology (STP 667), a compilation of 25 papers presented during a symposium program of the American Society for Testing and Materials, has been released by ASTM of Philadelphia, PA.

The publication covers the assessment of effects of pesticides, contaminants, and other chemicals or factors in the aquatic environment.

MEETING

Pesticide association discusses safe uses

"Chemicals will be an essential part of life in the future," said Chester L. Foy, head of Virginia Tech's department of plant pathology and physiology. Foy spoke at the Virginia Pesticide Association annual meeting which was held along with the Mid-Atlantic Agricultural Chemical and Equipment Trade Show on Jan. 23-24 at the Richmond arena.

"We can't go back to life as it was before pesticides," Foy said. "The world and science will not allow it."

Foy noted that contrary to public opinion, life expectancy has not decreased from the use of herbicides. He encouraged his audience to take the responsibility to get technology out of test tubes and into use.

Cecil Howes, Washington liaison officer for Tech's College of Agriculture and Life Sciences, gave the keynote address at the group's annual banquet. More than 300 listened to the talks and viewed booths of chemical and equipment companies.

Outgoing president James Gallman of the Stauffer Chemical Co. challenged the organization to double the number of exhibits by 1983. The newly elected president is Dennis Ketcham, sales representative of Du Pont Co. Other new officers are Joseph Will, vice president, Southern States Cooperative; Phyllis McCabe, honorary secretary, Chevron Chemical Co.; and Nora Hall Pankey, secretary and treasurer, Southern States Cooperative.

Continues on page 85

New. . . from Standard Golf Co.

Redwood for Instant Golf Course Beauty

Standard Golf Co. has added new dimension to golf course beauty with hand crafted redwood in tee data signs, benches and course signs. What beauty! What distinction and design harmony for your golf course! These beautifully sculptured custom redwood console units, developed by Cimter, Inc., are offered exclusively by Standard. Each tee can be decorated with precise hole layout information. Standard offers the signs with or without hole layout, in two styles and two sizes. Contact your Standard Golf Co. representative today. . . or write Standard Golf Co., Cedar Falls, Iowa for Catalog Number 300-80 and complete information on order time and production details. You and your members will be glad you made the move. Call 319-266-2638.

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1. DURSBAN insecticides last longest of all leading insecticides.
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In fact one application of DURSBAN 4E, ¾ oz. per 1,000 sq. ft., costs only about 45¢. Yet with this small amount, you get six to eight weeks of unsurpassed residual control of dozens of turf pests. Compare this to two to four weeks with any of the other leading insecticides.

And although DURSBAN insecticides are highly effective against insects, they are kind to turf, to people and to pets.

You also use a lower dosage rate with DURSBAN than with other leading insecticides. That means you handle fewer drums to do the job.

So ask your supplier for the turf insecticide that saves you time, trips, storage space and money. Ask for DURSBAN 2E insecticide or double-strength DURSBAN 4E insecticide. Just be sure to read and follow all label directions and precautions. Agricultural Products Department, Midland, Michigan 48640.

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THE CHALLENGES AND LIMITATIONS OF TREE PEST MANAGEMENT TODAY

By Henry Gilbertson, Director of Technical Services, Davey Tree Expert Co., Kent, OH.

Tree pest management continues to face challenges on both a regional and national basis. For an overview of these problems, The Davey Tree Expert Co. polled its district managers across the United States and in five districts in Canada. The findings were presented in a speech at the 12th Annual Northern Forest Insect Work Conference last year by Davey's Henry Gilbertson. This article is taken from that speech.

Henry Gilbertson is director of technical services for Davey Tree Expert Co., Kent, OH. He received his BS in Forest Management at the University of Idaho, his MS in Plant Pathology from the University of Maryland, and a second MS from the University of Massachusetts. He is currently a member of the Research Committee of the International Society of Arboriculture and served in the past as president of the Ohio Chapter of ISA. He is also a member of the American Phytopathological Society.

Bronze birch borer larva and its damage present such a problem that many hesitate to recommend planting of white birch. (Photo courtesy OARDC).

There are basic difficulties in controlling tree pests. These are in addition to those problems involving particular trees or pests.

It is impossible to be on every property at the right time or ideal time for spraying because of the great number of properties or trees that need protection. In some cases, we may not even know the ideal time, especially in those instances where the pest feeds over a relatively long period and the home owner can afford only one application.

We often receive calls after the damage is quite extensive or when the larvae are almost mature and tougher to kill. Some clients apparently expect the leaf injury to heal and become whole after sprays are applied!

Weather — rain, wind, high temperature or freezing temperature — can always cause a problem. The number of ideal spray days in a season can probably be counted on one hand.

Tall trees are a problem. Even with ideal conditions, it is difficult to thoroughly cover trees that are 85 to 90 ft. in height.

The fact that most of our insecticides have short residual and are used on insects that have extended egg-hatch periods or that may continue to reinfest a tree over a long period of time, makes control difficult. These factors must be tolerated and sometimes interfere with getting the spray on target with proper coverage and without plant injury.

Two other problems that need further publicity are the effect of temperature on insect control (for example, malathion is reported to be much less effective below 60 degrees F than at higher temperatures) and the effect of water pH used with the pesticide, which can reduce its chemical activity. Certain parts of the country have high pH water. What effect is this having on control?

The insects discussed represent a few of those prevalent problems to urban trees and, in some cases, problems for arborists to control.

Borers

Borers are one group of insects that create problems for the arborist, municipal forester and home owner. For this group, bronze birch borer is a major pest. It can kill large or small trees and is so destructive that we hesitate to recommend planting of white birch. Control success has varied, probably because larvae are protected most of their lives by bark, and adults may lay eggs over a six- to eight-week period. In looking over state recommendations, I found that one says to use two pints 20 percent lindane and another says to use two quarts (or twice as much). This could also be a factor in control. How much lindane and how many applications are required for control?

Dogwood borer is also a problem attacking the roughened bark or stresses areas. Several of our tree care territories have mentioned having the ash or lilac borer as a problem pest.

Continues on page 20

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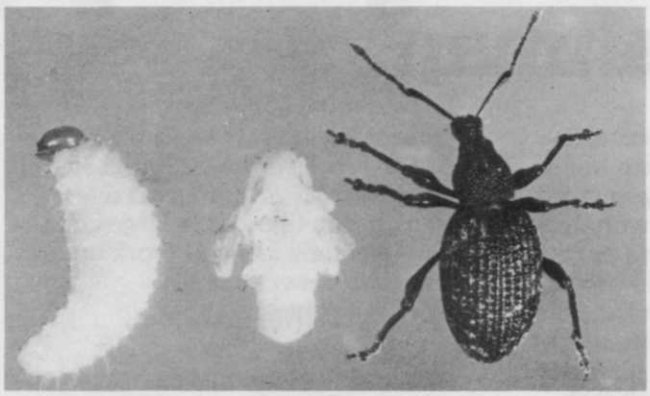

Black vine weevil larva, pupa, and adult (left to right). Photo courtesy OARDC.

Black vine weevil

Black vine weevil, although not a shade tree problem, is definitely an urban insect problem and is serious on taxus and rhododendron. The adult pest chews on the foliage, and damage is not readily noticed until the plant is dying because the larvae have been feeding on the root system.

With chlordane no longer available, we suggest the use of Orthene and understand that New York State has a 24-C or special local need registration covering this. Chevron Chemical Co. has told us that they have a recently approved label for Orthene which covers adult root weevils and they expect it to be available in time for applications this year.

Lindane is also labelled for this pest, although I have no information on its efficacy.

Scales

Scales are small but mighty and range from those that can kill trees or branches to those that are more noticeable because of the honeydew they secrete.

Cottony maple scale - The overwintering stage of the cottony maple scale could be overlooked by the homeowner. However, once the popcorn-like egg masses are produced and the tree starts to drip, our phone begins to ring. A single egg mass may contain 3,000 eggs, which easily explains any scale population explosion. Even an arborist may be mistaken about the success of his or her sprays unless he checks along the veins where the scale crawlers plug in to feed.

Oyster shell scale - This scale looks like oyster shell, hence its name. These scales overwinter in the egg stage and are more difficult to control with dormant oil sprays than if they were partly or full-grown scales. The addition of Ethion to the oil has improved control considerably. We follow up with a spray during the crawler phase.

Euonymus scale - Euonymus scale is hard to control. A close view will show yellowing caused by an infestation of the scale. Thick, bushy plants are difficult to cover thoroughly with spray and require special attention.

Magnolia scale resist control by forming a dense layer. (Photo courtesy of Davey Tree Expert Co.)

Galls

Although there are more than 800 different insect galls which may affect oaks, the one which is the real problem is the horned oak gall, caused by cynipid wasp. This has become a special problem in the Buffalo, NY, area, where it has killed hundreds of pin oaks; but it is also found in other areas.

An infested tree may look as if it were loaded with shishkabobs. A close look reveals the reason it is call horned oak gall.

Maple bladder gall commonly found on silver maple. (Photo courtesy Davey Tree Expert Co.).

Adults formed in the two-year-old gall chew their way out of the horns and lay eggs in the developing leaves. Wasps which develop in the leaf galls emerge about July 1 and pepper the new twig growth with eggs. New galls are produced, and after two years the cycle is repeated.

When DDT was available, we felt we were successful in our control efforts; but since then, control has not been satisfactory.

Aphids

Spruce gall aphids - Spruce gall aphids are not a serious problem where carbaryl is used, provided,

Continues on page 22

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of course, timing of the application is correct.

Eastern spruce gall can be found on Norway spruce and the Cooley spruce gall on blue spruce.

Overwintering stem mothers lay their eggs and start the process of gall development. Swelling at the base of needles starts very early, The gall can begin to develop before the bud cap is off. The aphids are protected in pockets inside the Cooley gall; here they feed and reproduce.

Woolly Oak aphid - Although the injury caused by the woolly oak aphid could be confused with leaf scorch, it actually is caused by masses of the aphids. This can be very injurious to leaves.

Pine bark aphid - Normally when pine bark aphid is mentioned, one thinks of aphids covering the main trunk and lower limbs. Control is more difficult when they feed on the base of the needles and are observed only as minute bits of cotton sticking out of the fascicle. I have seen Scotch pines that have been killed by the pine bark aphid.

Leaf miners

Leaf miners range from arborvitae leaf miner, which can wipe out a planting, to the birch leaf miner. Although I have not seen it kill birch, its damage may increase the possibility of attack by the bronze birch borer. The larvae feed between the leaf surfaces. The mining takes place in birch rapidly, making the timing of sprays critical.

Leaf chewing insects

Eastern or apple tent caterpillar and fall webworm are two pests that are present to some degree each year. They can completely defoliate a tree.

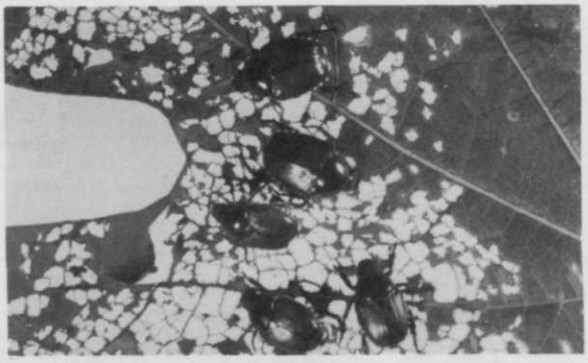
These pests are not so difficult to control, but their unsightly webs remain on trees long after they are gone.

Eggs of the fall webworm are laid over a four- to six-week period, making control difficult with the short residual insecticides, especially if the home owner expects 100 percent control with a single application.

Japanese beetle

The Japanese beetle seems to be on the increase. You are no doubt familiar with its life cycle. Linden is one of its favorite hosts, and sycamore is another.

Control of Japanese beetle is difficult, primarily because a sprayed tree can be reinfested over such a long period of time — at least two months. To prevent feeding damage, sprays would have to be applied weekly.



Japanese beetle is increasing its damage to many trees, especially linden and sycamore.

Pin oak sawfly

The pin oak sawfly skeletonizes the leaves, causing them to turn brown. The slug-like larva causes the injury. Usually an infested tree will "brown-up" before the home owner is even aware that a problem exists. This pest has been reported on the rise in the New Jersey area.

Research and extension needs

More information is needed on timing spray applications especially for those pests that hatch over a prolonged period or where adults lay eggs or feed over a four- to six-week period.

Phenological studies should be continued to help relate plant developmental stages with insect activity.

Long-range programs should include the effect of varying insect populations on the vigor of trees and shrubs. This type of study is being done on gypsy moth defoliation; hopefully, it can be done for other pests.

Weather has always been a problem. New application techniques are needed to provide the desired pest control and to reduce the chances of pesticide pollution to the environment.

How can we get coverage of the tall trees? How can we protect trees near the swimming pool or pond without the danger of polluting with drifting or dripping spray? How can we accomplish desirable results during adverse weather? Weather certainly influences the length of residual of an applied insecticide. How can we lengthen this period in order to provide better control with fewer sprays?

There is a need for studies on soil injections with systemics as well as injections directly into the tree. California has recently secured a special need label using Orthene injected into elms for elm bark beetle control.

If we are going to inject trees, we need teamwork from the plant physiologists on how to inject, where to inject, and the long-range effect of these wounds.

Last year we looked at the chemical distribution in elms injected with Arbotect. Bioassay of branch discs showed only 60 percent of the branches contained sufficient chemical to inhibit the test organism. What must be done to obtain 95 percent to 100 percent coverage?

It is well known that systemics move up in a tree, but rarely, if ever, down. Is there some way systemics could be tied into the phloem tissue where they might aid in the control of borers, twig scales, and other pests feeding in that area?

Help is needed from the arborist, municipal forester, and home owner to know when there is going to be an invasion of a certain pest. Is it practical to expect some assistance in predicting or forecasting outbreaks?

We are aware of the effect of insect defoliators on tree decline and mortality. Therefore, it would be very beneficial for all to know the likelihood of this defoliation occurring so that protective measures can be taken. **WTT**

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ASH, HACKBERRY AND KATSURATREE OFFER ELM'S URBAN ADAPTABILITY

By Douglas Chapman, Horticulturist, Dow Gardens, Midland, MI

Ash (*Fraxinus*), Hackberry (*Celtis*), and Japanese Katsuratree (*Cercediphyllum*) are three trees which offer adaption to many urban conditions (as did elm), be it park or landscape tree.

White Ash *(Fraxinus americana)* is a rapid growing tree which is easy to transplant. When young, it is a rather upright, oval tree that when reaching maturity (between 70 and 90 feet) becomes somewhat open and round. It often increases 3 to 5 feet in height per year when young. The summer foliage is somewhat bright green with fall color being quite exciting, ranging from a good clear yellow to purple. The insect problems include ash flower gall, scale, and, more significantly, ash and lilac borer. But it must be stressed that ash and lilac borer are only problems on trees which are not in good vigor. White Ash presently is showing some susceptibility to sulfur dioxide and ozone. 'Autumn Purple' White Ash, a male, thus seedless form, develops deep purple or magenta fall color. With increasing frequency, this plant has been showing problems of graft incompatibility or incongeniality, manifested by longitudinal cracking at or near the graft. Species White Ash not only has potential as a park tree, but also integrates well in lowland soils, fitting many urban landscapes as a specimen or border tree.

Green Ash *(F. pensylvanica lanceolata)* is a 50- to 60-foot tree with dense foliage. It displays a round habit of growth when old, yet pyramidal through early maturation. The fall color is a good clear yellow which can be a major addition to any landscape. Green Ash will grow in almost any soil, tolerating wet soils extremely well, while showing good tolerance to high pH and sodium or calcium chloride concentrations. Further, Green Ash is very sensitive to fluorides, slightly sensitive to ozone, and extremely tolerant of sulfur dioxide, making it an exceptional urban tree. Scale and borer can be a problem but somewhat less than we normally see on White Ash. 'Marshall's Seedless' Green Ash, a male green ash, has dark green foliage in the summer with outstanding clear yellow fall color. This seedless form again shows little problem with borers. Its habit is somewhat pyramidal when young, showing great potential as a street or border tree. 'Summit' Green Ash, with a strong central leader, has a somewhat symmetrical habit of growth. The plant is female, thus producing many seedlings, but is almost an ideal street tree. It has no problems with graft incompatibility.

> "These trees add diversity and help fill the niche opening by the death or decreased use of American Elm

Blue Ash *(F. quadrangulata)* has a somewhat irregular crown, reaching 50 to 75 feet in height. Although slower growing than the other ashes, it adapts well to wet-heavy clay, high pH soils. Ash borer can be a problem spring or fall, but, more significantly, oystershell scale and plant bug have caused major problems which should limit the wholesale use of this particular native species. The tree is outstanding for its dark blue-green summer foliage, but usually has very pale or no fall color. 'Kimberly' Blue Ash, a somewhat recent introduction, has a more uniform rounded habit of growth. The cultivar grows more rapidly, being landscape effective in street or park conditions as a specimen or mass plantings.

European Ash *(F. excelsior)* is a rounded tree, reaching 70 to 80 feet in height. It is extremely tolerant of urban conditions. It has good rich foliage in the summer, which remains late in the fall, thus developing little or no fall color. European Ash thrives on moist, loamy, alkaline soils found throughout much of the midwest. The main drawback in using European Ash is its extreme susceptibility to borer. In fact, even under ideal conditions, pest-free plants are rarely found. 'Hessei' European Ash, a vigorous grower with dark green summer foliage and a somewhat upright, oval habit, has been reported to show good resistance to borers, but our experience in central Michigan shows it is not much more resistant than species of European Ash.

Of the four ash species normally used in the landscape, Green Ash (*F. pensylvanica lanceolata*) is by far the best selection. It is a rapid grower that tolerates urban conditions, e.g. air pollutants, salt, etc., is less susceptible to borers, and grows well in wet, high pH soils, rarely showing ill effects from calcium or sodium chloride, applied for snow removal. Its cultivar, 'Marshall's Seedless' Green Ash, is an exciting street or park tree, not used to its full extent. Although ash fills an important niche in our landscape, certainly their wholesale use should be limited to plants showing best adaption to urban conditions. If there is such a thing as ranking from top to least desirable, Green Ash, White Ash, Blue Ash, and European Ash would be the order. Although borers have been reported to be a problem with all ash types, European Ash is certainly the most susceptible, with the other ash showing decreased susceptibility, in fact, almost immunity, if plants are kept in a healthy-vigorous state. Oystershell and other scales have caused some problems in the past, but the simple application of dormant oil in the spring, integrated into the maintenance program, can effectively control this problem. In working with flood plains, golf courses, or recreation sites, subject to flooding, ash should be considered an effective alternative, being a

Continues on page 27

Common Hackberry (left) tolerates heavy urban soils, grows to a height of 40 feet, and has black corky bark.
Japanese Katsuratree (immediately below) is fast growing, requires little pruning after reaching 15 feet, and makes a good specimen tree for parks, golf courses, institutional grounds and streets.
Clear yellow foliage of 'Marshall's Seedless' Green Ash in the fall (below left).
Purple foliage is the benefit of 'Autumn Purple' White Ash (below right) a seedless, male form.

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Ash *from page 24*

plant that not only tolerates but thrives on wet soil conditions. This genera can add tree canopy rapidly while being very effective for fall color.

Common Hackberry *(Celtis occidentalis)* is a native throughout the midwest. It tolerates heavy, urban soil conditions well. Its upright, spreading habit, often reaching 40 feet in height, with black corky bark, can be an exciting addition to the winter landscape. The plant normally has good, wide-angle crotches, responds well to pruning, while being relatively resistant to wind and ice storm problems. In the southern part of its range (southern Michigan and Ohio) witches broom can be a problem, but further north this problem is rarely significant. Nipple gall does cause objectionable galls on the foliage but is certainly not an insect problem that will kill the plant. Hackberry is one plant that grows in most urban areas where elm thrives. It seems to tolerate urban conditions well and should be used more extensively as a park or street tree on these heavy soil sites. The fall color, although not exceptional, can certainly add variation and light yellow tinges to the landscape. Ash and hackberry are good companion plants that grow well in areas where many plants decline.

Japanese Katsuratree *(Cerediphyllum japonica)* is a medium-sized oval tree effectively reaching 50 to 70 feet in height. The heart-shaped leaves with the dual terminal make this a unique plant. The summer foliar color is blue-green with fall color ranging from scarlet to a clear brilliant yellow. This medium to large size tree is an outstanding specimen plant for use in parks, golf courses, institutional grounds, or as a street tree. It is fast growing, requiring little pruning, after reaching 15 feet in height. The largest tree in the midwest, in fact, the country, is on the Michigan State University campus. During the past 18 years, I have not noted a major insect or disease problem. Katsuratree is a plant found rarely in the trade, but one which should be grown with increasing frequency.

Katsuratree, hackberry, and ash all grow well in moist, fertile soils. They are fast growing, respond well to fertilizer, and, if pruned actively when young, form a good structure. When considering maintenance, they would rank Katsuratree, hackberry, and ash, with ash being the most maintenance intensive by virtue of insect-related problems. Most of these trees withstand urban conditions well and would not only add diversity but certainly effectively fill the niche rapidly opening by the death or decreased use of American Elm.

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KNOWLEDGE OF SPRAY EQUIPMENT CONTRIBUTES TO APPLICATOR EFFICIENCY

By John Kerr, Assistant Editor

Knowing how spray equipment functions not only makes someone a better applicator, but can save valuable time during work or back at the shop. A basic understanding of the spray system can provide, at the least, an intelligent and time-saving report of a malfunction, should one occur.

Since Green Industry operations often expand into new arenas, a sprayer used on lawns may also have to spray trees. "It makes no sense to have a system for each application," says Ed Gray, sales engineering manager of Spraying Systems Co. Also, many new and improved pesticides have recently become available and costs have risen sharply. Consequently many users have had to replace or modify their sprayers or spraying methods to meet changing requirements or to improve efficiency.

Once you've decided on what chemical to spray, you need to know how to spray it. "The chemical does the work; it just has to be applied at the proper rate and time, according to the manufacturer's specifications," says Gray. "If you have the right equipment, you're halfway there."

The right equipment on a spray system, according to the Weed Science laboratory manual written by Dr. William Meggitt and Jack Dekker of Michigan State University, consists of five basic components. These are the tank, nozzles, agitator, pump, and regulating devices. Much of the authors' research follows.

All possible uses for a spray system should be considered before purchasing a unit.

Tanks

Tanks for large scale spray systems are non-pressurized. These can be large (generally the bigger the greater the soil compaction problems) without being prohibitively expensive. In this system, a pump produces liquid pressure at the nozzle. Pressure exists in the system only from the pump to the nozzles. There is usually a suction from the tank to the pump. Non-pressurized tanks should be mounted so that the bottom of the tank is above the pump.

Tanks should be made of, or coated with, a corrosion-resistant material, such as stainless steel, aluminum, plastic, fiber glass, and steel with or without coatings. Chemicals may be corrosive to certain materials and care should be taken to avoid using incompatible equipment.

Keep tanks clean and free of rust, scale, dirt, and other contaminants. Solid particles from a tank can quickly wear out a pump and nozzle tips. Dirt may collect in the nozzle and restrict the flow of chemical resulting in improper rates of application. Debris from the tank can clog strainers and restrict flow of spray through the system.

Flush the tank with clean water after spraying is completed. A tank with a drain hole near one end permits tilting the tank to allow for complete drainage. An opening in the top large enough for internal inspection, cleaning, and service is desirable.

A volume sight gauge on the tank aids in efficient spraying. On metal tanks a clear plastic tube mounted on the end, marked off in gallons, works well. On clear plastic or fiber glass tanks, place marks on the side of the tank to indicate gallons.

If you are applying a chemical that requires agitation, keep the agitator running at all times when the chemical is in the tank. It is recommended to agitate the mixture in the tank before spraying. If the equipment is shut off and the chemical settles out, it may be very difficult to get the chemical into suspension.

Nozzles

Sprayer design and modification starts with the selection of the proper nozzles for the type of spraying to be done. It is the nozzles that break the liquid into droplets of optimum size, form the spray pattern and propel the droplets in the proper direction. The nozzles also determine the rate of chemical distribution at a particular pressure, forward speed, and nozzle spacing. Only after the nozzles have been selected and their total volume and pressure requirements measured (or computed) can the other elements of the sprayer be chosen or properly adjusted.

People involved in several different operations, such as spraying herbicides or insecticides, usually need to change their nozzles and orifice tips. Basically the same nozzles work well for landscape and turf care that work for agricultural purposes. A boom can have one nozzle or 20 depending on how wide of a swath you want. To a sprayer's pump-tank package, you can attach a boom to spray the lawn, a boom or gun to spray one side of a right-of-way or ditch, and a heavy-duty spray gun to hit the tops of trees. "The bottom line is the proper application rate, which is controlled by the spray tips," says Ed Gray. "Tips and nozzles are a minor investment compared to the whole rig, but since they control the rate of application, they are very important in terms of calibration, performance, and choice."

Continues on page 30

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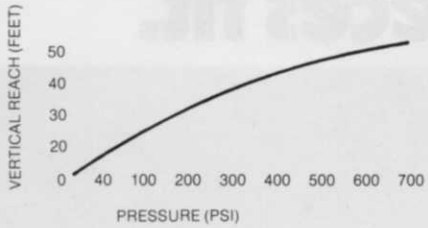

Height limitations of spray systems and nozzles should reduce wasteful and ineffective spraying over certain heights.

Table 1. Wear Comparison of Common Nozzles

Nozzle Material	Life Compared to Brass
Plastic or Nylon	Same
Aluminum	Same
Stainless Steel	3.5 times
Hardened Stainless	10 to 15 times
Tungsten Carbide	150 to 200 times

Table 2. Summary of Nozzle Types and Their Uses

Nozzle Type	Distribution of Droplets	Main Use
Flat Fan	Uniform when the boom is at the proper height. Best for broadcast spraying.	Herbicides or insecticides.
"Even" Spray	Not uniform for broadcast spraying. Good for band spraying.	Herbicides.
Full or Hollow Cone	Not uniform when used on a boom.	Insecticides.
Flooding Fan	Not uniform as flat fan nozzle.	Liquid Fertilizer and herbicides.
Boomless	Not uniform. Very poor in wind.	Herbicides in waste places.

Nozzle tips are made from several types of material. The most common types include brass, aluminum, nylon, stainless steel, and hardened stainless steel. Brass and aluminum tips are the cheapest, but the metal is softer and the tips wear faster. Nylon tips resist corrosion and abrasion, but some chemicals cause nylon to swell. Tips made from harder metals cost more, but wear longer. Tests have shown that 2,4-D may wear nozzles enough to increase the rate of chemical flow 8 percent in a period of 50 hours. A 10 percent increase may not be readily noticeable, but if 150 acres is sprayed with a chemical that costs $5 more per acre, a 10 percent increase in spray volume will cost $75 more.

Each nozzle on a spray rig should apply the same amount of chemical. Collect the discharge from each nozzle and compare the output. If the discharge from one nozzle varies more than 10 percent above or below the average of all the nozzles, replace it.

Do not mix nozzles of different materials, different discharge angles, or gallon capacity on the same sprayer. Any one of these will produce uneven spray patterns.

If spray nozzles become clogged from foreign matter or from contact with soil, care must be used in cleaning. It is best to disassemble the nozzle and blow out the dirt with compressed air. A soft bristled brush such as a toothbrush can also be used. Never use a nail or wire to clean the nozzle because they can easily damage it.

Nozzle spray patterns vary to accommodate a particular broadcast application. Table 2 summarizes the various nozzle types and their uses.

With a flat fan nozzle, the spray droplets arrange in a fan shape as they leave the spray nozzle. Less material applies along the edges of the spray pattern, so the patterns of adjoining nozzles must be overlapped to give a uniform spray across the length of the boom. Normal operating pressure is 30 to 40 psi which may cause drift. Lower pressures will reduce this. It can be used for most herbicides and some insecticides where penetration through the leaves is not required.

The "even" spray nozzle produces a fan-type pattern, but uniformly distributes the spray across a width. This pattern is ideal for band spraying where there is no overlap from other nozzles. Operating pressures of 40 psi will reduce the possibility of spray drift. Width of the band is dependent upon the nozzle placement above the ground.

A hollow cone nozzle produces a spray pattern with most of the liquid concentrated at the outer edge of a conical pattern. This nozzle is used mainly for applying insecticides, fungicides, and certain postemergent herbicides where complete coverage of the leaf surface is very important. Use the hollow cone pattern for low volume applications where a fine spray pattern is needed for thorough coverage. Use the solid cone spray pattern for high volume application where dense foliage requires a coarse spray for good penetration around plant leaves.

The flooding fan nozzle produces a wide, flat spray pattern that you can direct outward, down, or up. Use it for any application requiring wide coverage at low pressures with large droplets. The flooding nozzle works well for applying herbicides and mixtures of herbicides and fertilizers and it will operate at lower pressures than flat fan nozzles with less drifting.

A boomless nozzle consists of a cluster of nozzles capable of spraying widths of 30 to 60 feet. It suits spraying of roadsides, ditch banks, and right-of-ways. The spray is more susceptible to drift than nozzles mounted on a boom, and the distribution across the swath is not as uniform.

Continues on page 34

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A line strainer, or suction hose and strainer, is necessary to prevent rust, scale, and other foreign particles from damaging the pump and clogging the nozzles. For most emulsifiable chemicals used, a screen of 100 mesh should go in the line strainer and nozzles. If wettable powders are used, so should screens of 40 or 50 mesh to allow unrestricted flow.

The chemical package label of a pesticide usually recommends the proper pressure for spraying. Low pressures of 30 to 40 psi are usually sufficient for spraying herbicides or spreading fertilizer, but high pressures up to 400 psi may be needed for spraying insecticides or fungicides.

Since nozzles are designed for a certain pressure range, they must be used as such to get the proper application rate. Higher pressures increase the delivery rate, reduce the droplet size, and distort the spray pattern, which results in spray drift and uneven coverage. Lower pressures reduce the spray delivery rate and the spray material may not form a full spray pattern. A minimum pressure of at least 20 psi is usually necessary to produce a good spray pattern with most nozzles.

Agitator

Another item that must be considered before selecting the power package for a sprayer is the need for agitation. Liquid concentrates, soluble powders, and emulsifiable liquids require little agitation. But to keep wettable powders in suspension so that the chemicals will not settle out, causing the application rate to vary, requires intense agitation. This comes by means of a separate agitator, either a jet type or mechanical.

A jet agitator operates by a return pressure line hooked into the system directly behind the pump and should be positioned in the tank to provide agitation throughout. For a simple orifice jet agitator, a flow of 6 gpm per 100-gallon tank capacity is usually adequate. There are several types of suction venturi attachments available that help stir the liquid with less flow. With these, the agitator flow from the pump can be reduced to 2 or 3 gpm per 100-gallon tank capacity.

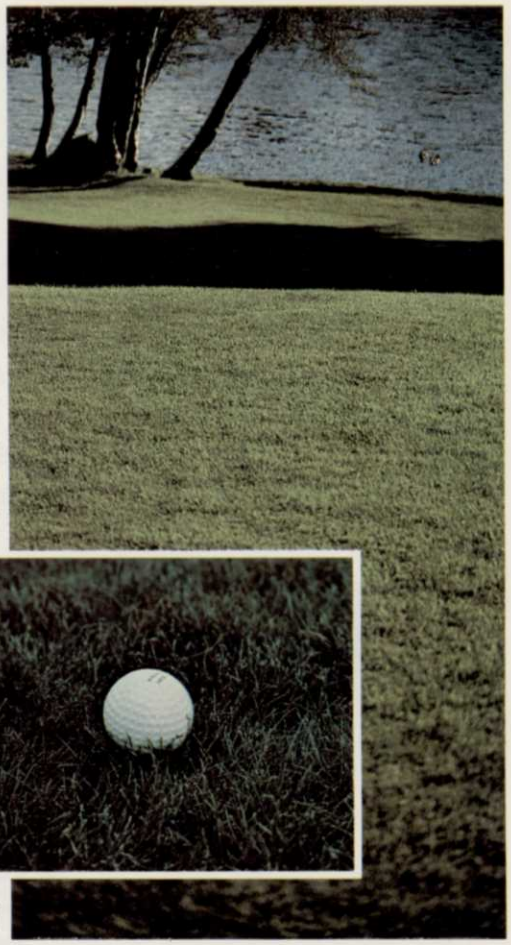
A mechanical agitator with a shaft and paddles will do an excellent job of maintaining a uniform mixture, but is usually more costly to install than a jet agitator.

Pump

Those who use their sprayers for several different kinds of spraying—herbicides for different weed control problems, insecticides, or fertilizers—face the need to change nozzles or noz-

Continues on page 36

OREGON FINE FESCUES
The Park and Golf Course Grass



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zle placement, to provide more agitation, increase ground speed, or apply chemicals at higher rates. Often these changes result in a need for a different or larger pump.

A sprayer pump must have sufficient capacity to operate the agitators as well as to supply the nozzle requirements. In fact it is recommended that the pump capacity be 20 percent greater than the sum of these requirements for the largest volume sprayed. This will allow for sufficient capacity if the pump wears and loses some strength.

If you plan to buy or build a sprayer, it's a good idea to anticipate what applications you may be using it for to determine the proper pump. Often, a pump works fine for two different jobs. For example, Myron Koistinin, applications engineer for Hypro, a Div. of Lear Siegler, Inc., says: "For lawns and trees, you can have a small spray boom that you can pull with a garden-type tractor and in addition have a hose reel that's set up on the trailer frame and a handgun to spot spray trees." Yet, he adds, if you use a field sprayer which requires relatively low pressure, it may not interchange for the high pressure needs of a tree sprayer.

The pump parts should resist the corrosive and abrasive effects of chemicals so that if wear or damage does occur it can be serviced easily. Other things to consider are pump cost, pressure requirements, ease of priming, and power source available.

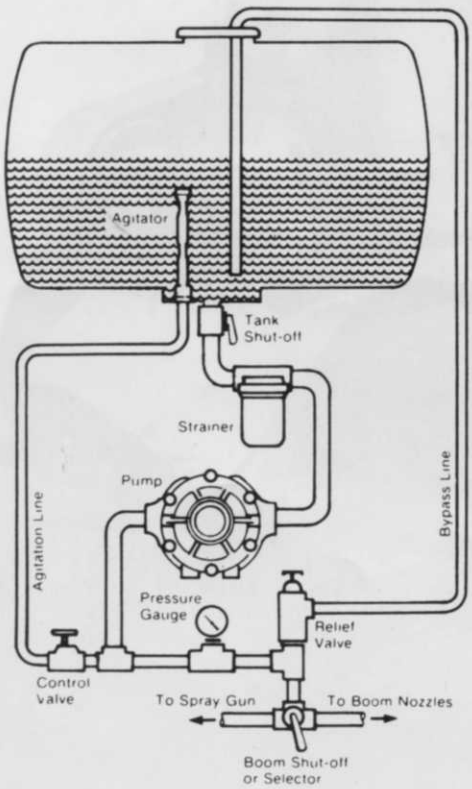


Figure 1. Roller pump system.

Most of the pumps used on weed and pest control sprayers are of three general types:

1. Roller or rotary pumps with rolling vanes
2. Centrifugal pumps
3. Piston pumps

Roller pumps have enjoyed wide popularity due to their low initial cost, compact size, easy repairability, and efficient operation at tractor PTO speeds. Moreover, their volume and pressure ranges are adequate for most spraying jobs.

A slotted rotor in the pump revolves in an eccentric case and the rollers move in and out radically to seal the spaces between the rotor and the wall of the case. As the rollers pass the outlet port, these spaces contract again directing the fluid out. Pump capacity is determined by the length and diameter of the inside case, its eccentricity, and the speed of rotation. The pressures produced by roller pumps will range to 300 psi and capacity at low pressures will range up to 300 gpm.

Roller pumps come with cast-iron or corrosion-resistant housings and nylon, Teflon, or rubber rollers Nylon rollers have proved to be the most resistant to chemicals and are recommended for multi-purpose sprayers. Sand or scale in the chemical being pumped is very abrasive to the rollers. Roller pumps should have factory-lubricated ball bearings, stainless steel shafts, and replaceable shaft seals. If bearings contain a grease fitting, do not overgrease them to cause damage or bearing failure.

Figure 1 shows the recommended hookup for roller pumps. The control valve is placed in the agitation line so the bypass flow is controlled, which will regulate the spraying pressure.

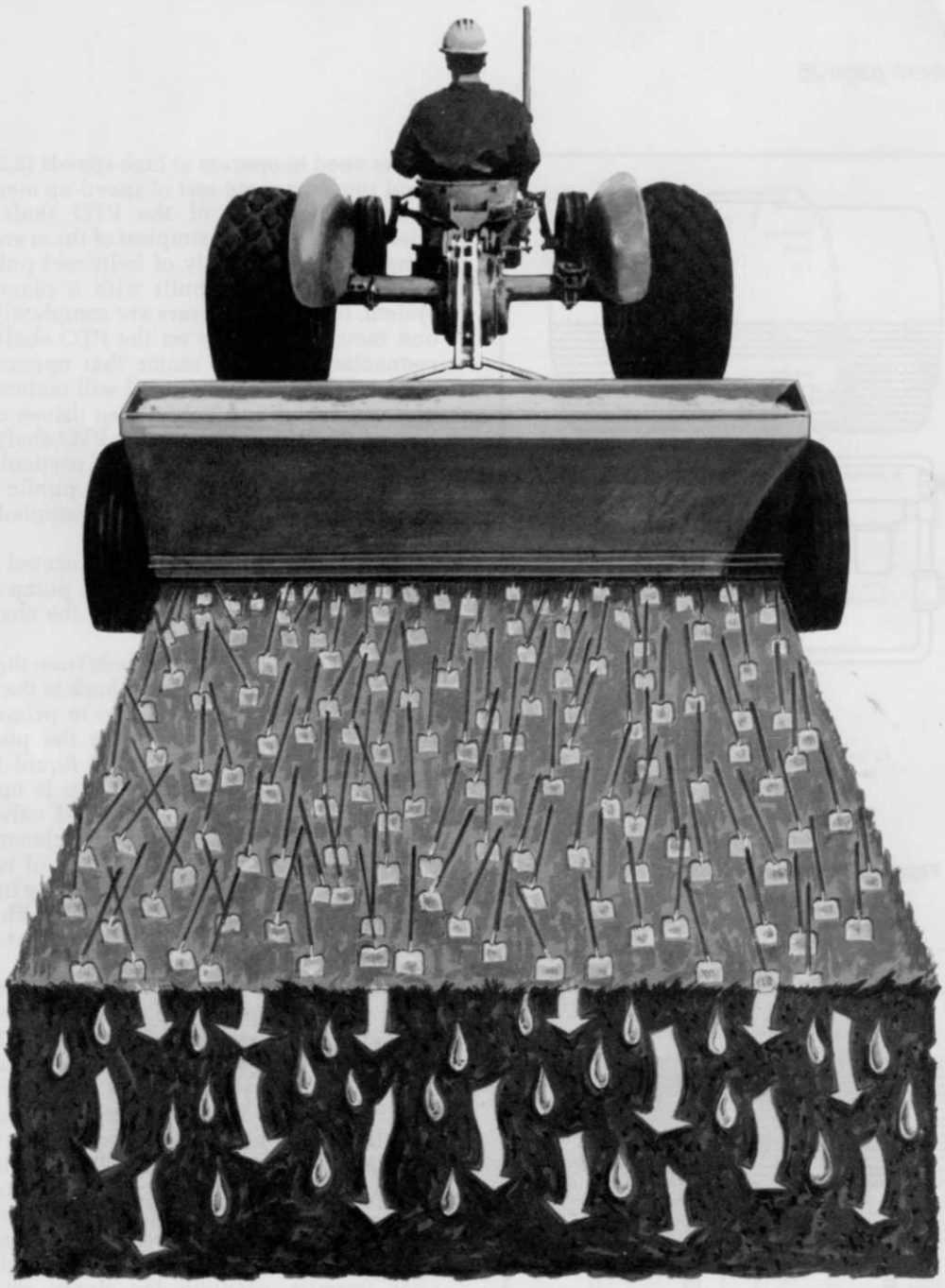
To adjust the system, close the control valve and open the boom shut-off valve. Start the sprayer, making sure flow is uniform from all spray nozzles, and adjust the relief valve until the pressure gauge reads about 10 to 15 psi above the desired spraying pressure. Slowly open the control valve until the spraying pressure is reduced to the desired point. If the pressure will not come down to the desired point, replace the agitator nozzle with one having a larger orifice. If insufficient agitation results when spraying pressure is correct and relief valve is closed, use a smaller valve for the same pressure.

Roller pumps are usually installed directly on the tractor PTO shaft. Anchor the pump to the tractor with a chain. This will allow the pump to move and reduce wear on the bearings if any misalignment exists.

Centrifugal pumps have become increasingly popular in recent years. They handle wettable powders and abrasive materials very well and their high capacity (70 to 130 gpm) provides plenty of volume for operation of hydraulic agitators in the tank.

They are capable of developing pressures up to 170 psi, but volume falls off rapidly about 30-40 psi. This steep performance curve is an advantage as it permits controlling pump output without a relief valve. However, high sensitivity to speed and inlet pressure variations makes for uneven pump output under some operating conditions.

Continues on page 38



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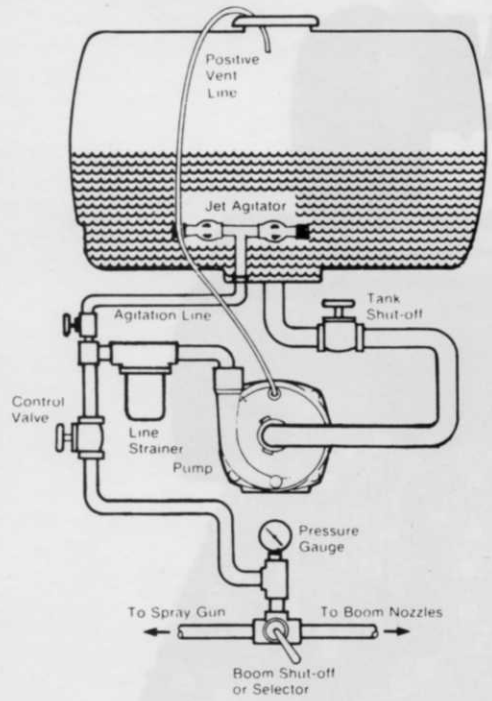

Figure 2. Centrifugal pump system.

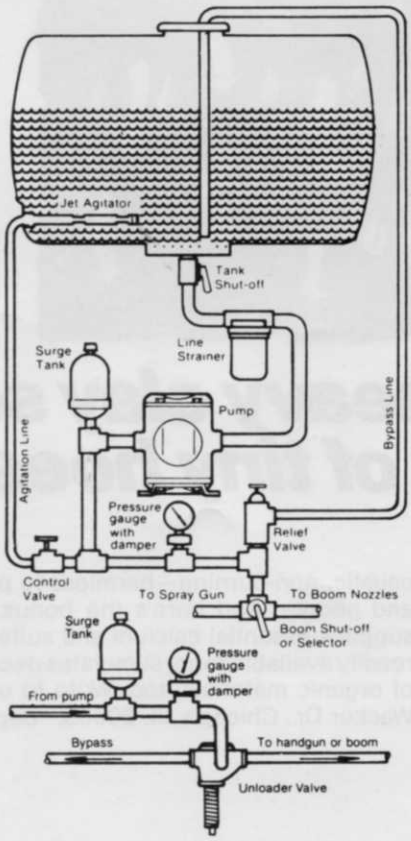

Figure 3. Piston pump system.

The need to operate at high speeds (3,000 to 4,500 rpm) requires some sort of speed-up mechanism to convert the speed of the PTO shaft to pump operating speed. The simplest of these and least expensive is an assembly of belts and pulleys.

Some pumps are built with a planetary gear system, in which the gears are completely enclosed and mounted directly on the PTO shaft. A direct connected hydraulic motor that operates off the tractor hydraulic system and will maintain a more uniform speed and output also drives centrifugal pumps. This frees the tractor PTO shaft for other uses. On some larger sprayers, particularly those used for applying herbicides on public lands, the pumps are driven by direct coupled gasoline engines.

Centrifugal pumps should be located below the supply tank to aid in priming the pump and maintaining a prime. Figure 2 shows the changes from roller pumps.

A small plastic vent tube leads from the top drain opening in the pump housing back to the tank. This positive vent allows the pump to prime itself by bleeding off trapped air when the pump is not operating. The small stream of liquid that flows back to the tank when the pump is operating is usually of little concern. No relief valve is used, since the pump is not a positive displacement type.

The final modification is the use of two control valves in the pump discharge line, one in the agitation line and one to the spray boom. This permits controlling agitation flow independent of nozzle flow.

To adjust for spraying, open the boom shut-off valve. Start the sprayer running and open the control valve to desired spraying pressure. Then open the agitation line valve until sufficient agitation is observed. If spraying pressure drops, readjust the control valve to restore desired pressure. Make sure flow from all nozzles is uniform.

A piston pump is a positive displacement pump, which means that its output is proportional to speed and virtually independent of pressure. It works well for wettable powders and other abrasive liquids. Either rubber or leather piston cups permits adapting the pump to water or petroleum based liquids and a wide range of chemicals. Lubrication of the pump is usually not a problem.

Piston pumps, although more expensive than other types, are dependable, highly adaptable, and have long life.

Larger sized models have capacities to 25 gpm and develop pressures to 600 psi. They usually require a surge tank at the pump outlet to reduce line pulsation.

Figure 3 shows the connection diagram for a piston pump. It is similar to a roller pump, except that a surge tank has been installed at the pump outlet. A damper in the pressure gauge stem reduces the effect of pulsation. When pressures above 200 psi are used, the relief valve should be replaced by an unloader valve. This will reduce the pressure on the pump when the boom is shut off.

Continues on page 41

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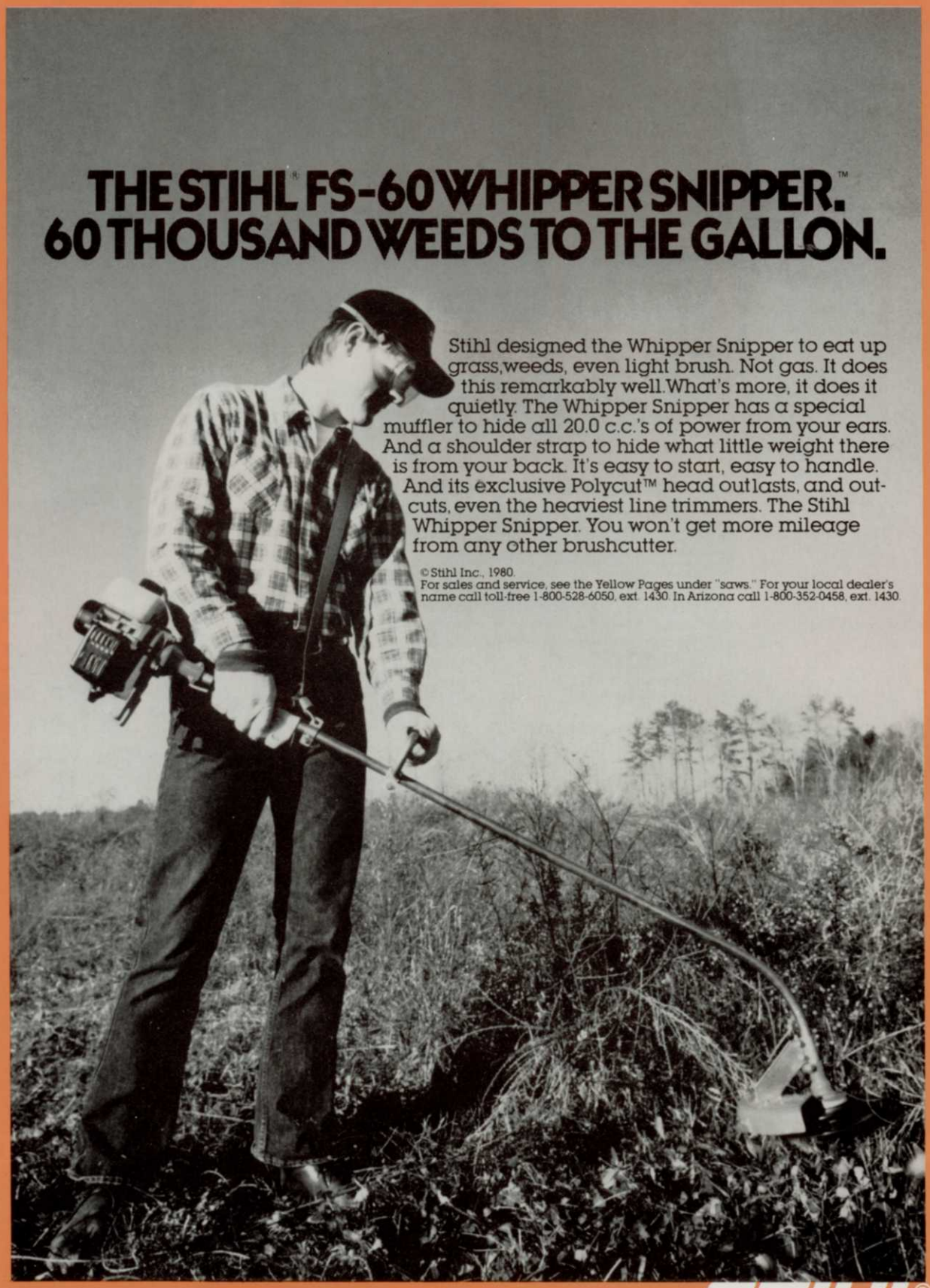

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Equipment *from page 38*

To adjust for spraying, open the control valve and close the boom valve. Then adjust the relief valve to open at a pressure 10 to 15 psi above spraying pressure. Open the boom control valve and make sure flow is uniform from all nozzles. Then adjust the control valve until the gauge reads desired spraying pressure.

Other less common pumps include the gear, flexible impeller, sliding vane impeller, diaphragm, and internal idle gear. Gear pumps work best at low pressures spraying pesticides that do not contain abrasive materials. The flexible impeller will handle mildly abrasive materials as well as a number of other chemicals which will not scratch the housing or cause the impeller to deteriorate.

Selecting the right pump is very important. "The type, volume, and physical nature of a pump determines whether you can add to a spraying system," says Bob Oberg, engineer at Broyhill. "Municipalities and many private operators at golf courses and lawn care companies will buy a good quality pump to begin with because it gives them a wider range of abilities." Oberg says his company sells a lot of large piston pumps where operators can use them for low pressure boom spraying and high pressure hand gun spraying. "Many turf spray operators will have a pumping system which can adapt to a variety of jobs more than agricultural sprayers, and are easily able to add a boom or handgun if they didn't already have one."

It should be noted that for spraying tall trees, it is more effective to increase the nozzle size than pump pressure. The greater the nozzle capacity and the narrower its spray pattern, the higher it will reach. Spraying Systems' Ed Gray says that at 40 psi, his company's sprayer can shoot 38 feet. You would have to increase the pressure to 800 psi to shoot 65 feet. Unless you treat many tall trees, it would not be economical to buy a high capacity pump. An interchangeable orifice tip is the most practical way to extend your spray reach, according to Gray.

Regulatory devices

A pressure regulator with by-pass line is needed to control the pressure, and thereby the delivery rate, of the liquid in a spray system. Since the actual discharge rate of any system is determined by the pressure at the nozzles, a pressure gauge should be mounted as near to the boom as possible.

A pressure gauge should have a total range twice the maximum expected reading. It is important that the gauge reads accurately and dependably. When calibrating, it is recommended to measure the discharge rate at a specific pressure on the gauge. If corrosive chemicals or a piston pump are used on a sprayer, install a gauge protector to prevent damage.

Screens in the main line, and before each nozzle, are needed to prevent foreign matter from entering the spray system and blocking the flow or changing the spray pattern. Screens should not be finer than 50 mesh if wettable powders are used. Boom controls are also needed to regulate which boom sections are operating at any given time.

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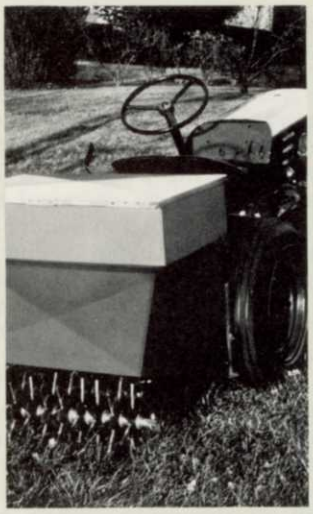

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Equipment *from page 41*

A relief valve is designed as a safety device to release liquid from a pressure system or line when the pressure exceeds a set level. By setting it to open at a desired spraying pressure, it is continuously bypassing any excess chemical back to the tank. It must be large enough to handle the entire pump capacity when the boom is shut off.

On spraying systems which operate at pressures over 200 psi, an unloader valve should be used in place of a relief valve. This unloads the pressure from the pump when the boom is shut off.

Boom control valves will direct the flow of chemical to a portion of the boom, the entire boom, or shut off the flow completely. Two types of flow controls are available: a manual control, which is mounted in the spraying hoses so it is accessible by the operator, and an electronic control. Nozzles mounted on sprayers should contain check valves which open at about 5 to 7 psi. These help prevent nozzle drip around edges.

Among other factors to consider for a spray system, along with the basic anatomy and the skill to adapt it to various purposes, are adjusting spraying volume, calculating the amount of pesticide needed, and mixing the chemical in the tank. Meggitt and Dekker offer the following tips:

Adjusting spraying volume

There are three basic methods for adjusting the volume of liquid sprayed:

1. Change the nozzle tips: This is the best method for making major changes (greater than approx. 25 percent) in the delivery rate of the sprayer. A smaller orifice in the nozzle tip means less spray delivered, and a larger orifice increases the delivery rate. Always select the nozzles for the job you want done.

2. Change the pressure: This is the least desirable method because pressure change will alter the nozzle pattern and droplet size. Reducing the pressure too much greatly reduces the spray angle and increases droplet size so plant coverage may be inadequate. Increasing the pressure increases production of small droplets and may contribute to an unacceptable drift problem. Also, a relatively large change in pressure is required for smaller changes in volume.

3. Change the speed of travel: This method is practical for smaller changes (less than about 25 percent) in delivery rate. The rate of delivery is inversely proportional to the speed; i.e., slower speed means more spray delivered, and a faster speed means less spray delivered per unit area. Slower speeds usually do not adversely affect a pesticide's performance, but too much speed increase may cause too wide a droplet distribution for acceptable chemical performance.

In some cases, it may be desirable to change all three variables. For example, you may wish to increase the spraying speed without changing the number of droplets or droplet size. Therefore, you could increase the nozzle size to partially compensate for the required increase in volume, and then increase pressure to reduce the droplet size from the larger nozzle and to increase the volume to the final target rate.

A sprayer cannot safely be calibrated from calculations, because of variations in speedometers, pressure gauges, hose sizes, nozzle wear, etc. The calculations will be near the desired rates, but a final calibration test is essential.

Calculation of the amount of pesticide needed

Many different approaches work to calculate the amount of pesticide needed. Which formula is not important as long the correct rate is obtained. The following are formulas for dry and liquid formulations that suit many problems:

1. Dry formulations: (wettable powders, granules, soluble powders, dusts, baits) Remember that commerical pesticides rarely are 100 percent pure active ingredient. Therefore, more weight of commercial pesticide is needed than active ingredient.

$$\text{pesticide weight/unit area} = \frac{\text{weight active ingredient/unit area desired}}{\text{percent active ingredient in product (expressed as a decimal)}}$$

2. Liquid formulations: (emulsifiable concentrates, flowable solutions) A ratio frequently is used to calculate amount of liquid formulation needed with one side of the ratio being the concentration of active ingredient per unit volume (pint, quart, gallon).

$$\frac{\text{weight of active ingredient}}{\text{volume containing the weight of active ingredient}} = \frac{\text{weight active ingredient/unit area desired}}{\text{volume of product/unit area}}$$

Guidelines for tank mixing

These guidelines are not a substitute for following label directions, but generally are the best procedure when more specific guidelines are not provided.

1. The sprayer tank must be clean. Oil, grease, old chemical residues, and other organic substances can be a primary cause of incompatibility.

2. Fill the tank at least one-half full to two-thirds full with water or the liquid fertilizer. Turn on the agitator immediately.

3. Premixing the pesticide with water or liquid fertilizer can substantially reduce compatibility problems. Premixing can be made in buckets.

4. The compatibility agent sometimes can be added to the premix or last to avoid foaming. Follow instructions provided with it.

5. Add the pesticide slowly to the sprayer tank. A wetting basket of cloth or 20 to 25 mesh screen over the tank filling port will assure slow addition to the tank, along with screening out lumps and foreign material.

6. Add the different pesticide formulations in the following sequence:

A. Soluble powders—must be completely dissolved in the tank before adding other pesticides. Pre-dissolving in water or in liquid fertilizer is desirable.

B. Wettable powders—make a slurry in water or the liquid fertilizer and add slowly to the sprayer tank.

Continues on page 44

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Equipment *from page 42*

This will avoid the possibilities of invert emulsions.

D. Emulsifiable concentrates—generally can be added slowly and directly to the sprayer tank. If compatibility or an invert emulsion occurs, premix in water or liquid fertilizer and add slowly to the sprayer tank.

E. Soluble liquids—usually can be added slowly and directly to the sprayer tank, or premixing in water or liquid fertilizer may be required.

7. Finish adding the remaining water or liquid fertilizer. Maintain good agitation at all times, although too vigorous agitation may cause foaming or incompatibility problems. If agitation should stop for any reason, be sure that the contents are fully agitated again before starting to spray.

8. If an incompatible mixture forms in the sprayer tank, add a compatibility agent to attempt dispersal.

9. Use the spray mixture as quickly as possible. Clean the sprayer thoroughly when finished. Most pesticides are formulated with organic solvents that may damage organic sprayer components such as hoses and gaskets. Some pesticides are corrosive and may damage the pump, tank, or other metal parts if allowed to remain too long in a tank. The label will contain special instructions if a certain sprayer part is especially susceptible to damage from the pesticide formulation.

These guidelines along with a working knowledge of a sprayer's anatomy should help an applicator analyze his own equipment needs and diagnose problems, to a certain extent, when they affect his equipment. Manufacturers are also very willing to help with choosing and adapting the proper spraying equipment for your needs. As Hypro's ad manager, Al Henjum, says, you may very likely change applications and not always know what equipment changes are also necessary. "The key," he says, "is to have the whole system in balance." **WTT**

We'd like to thank manufacturers of spraying equipment for their cooperation in this article. A special thanks goes to William Meggitt and Jack Dekker of Michigan State University whose manual is an excellent and comprehensive text on the subject of spraying equipment. If you'd like a copy of their lab manual for Weed Science contact Michigan State University Press, E. Lansing, MI 48824.

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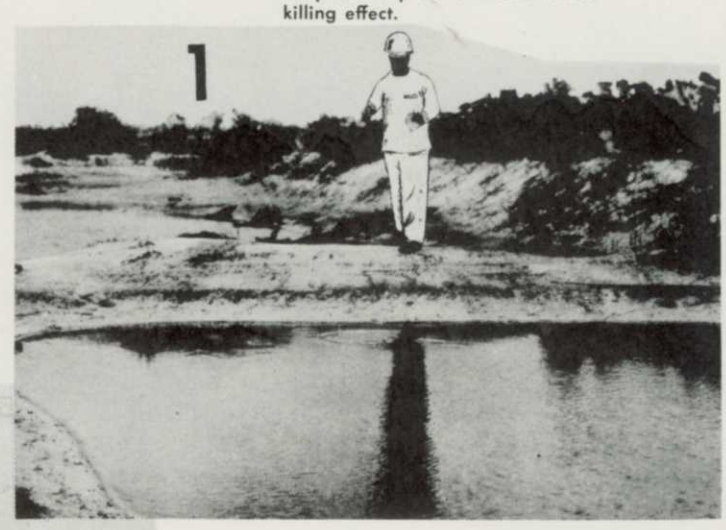

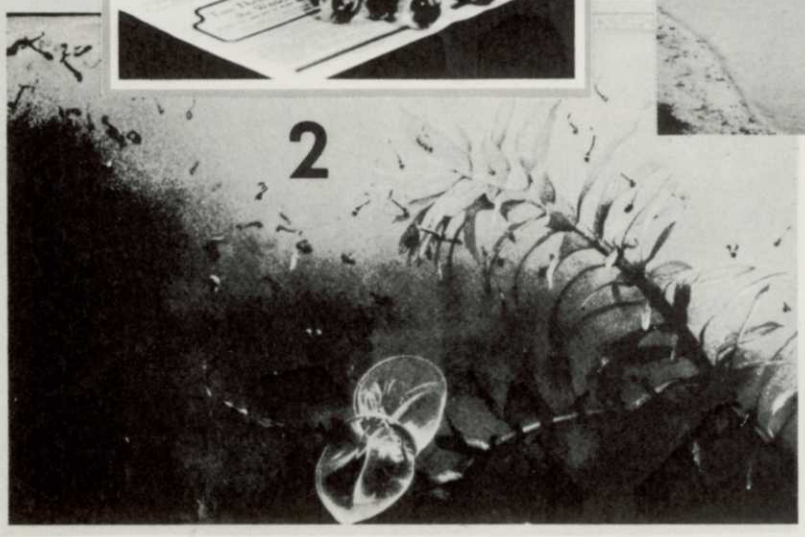

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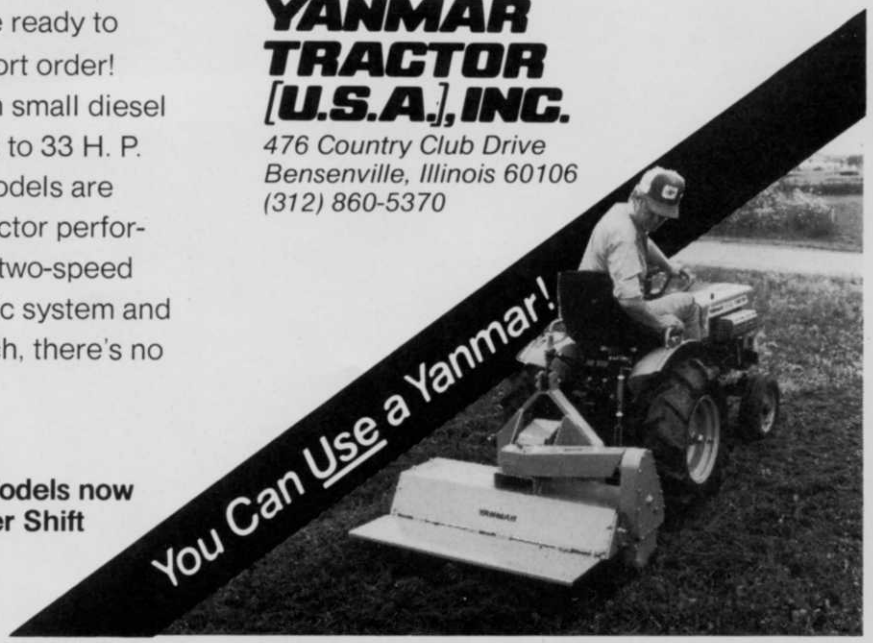

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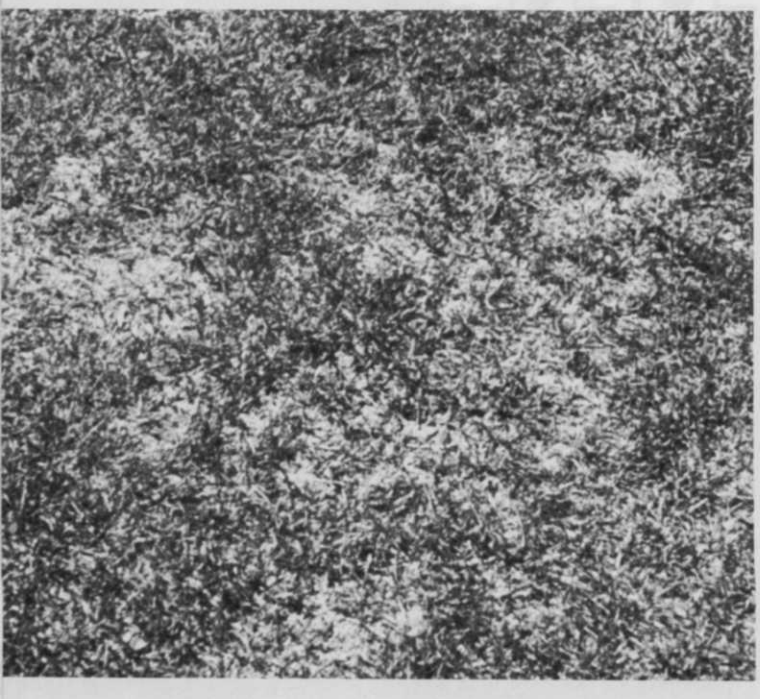
SYMPOSIUM ON LEAF SPOT MANAGEMENT

HELMINTHOSPORIUM DISEASES FEATURED AT CONFERENCE

By R.C. Shearman, Turf Specialist, and **J.E. Watkins,** Extension Plant Pathologist, University of Nebraska, Lincoln

Symptoms are in two phases, leaf spot in cool seasons (above) and melting out in warmer weather (below).



Helminthosporium leaf, crown, and root diseases are among the most common and serious diseases of all cool season turfgrass species. This disease complex is caused by several species of *Helminthosporium* fungi, including *H. vagans, H. sorokinianum, H. giganteum* (zonate eyespot), and *H. dictysides* (*Helminthosporium* blight). Generally, *Helminthosporium vagans* causes the most serious damage to cool season turfs such as Kentucky bluegrass, but *H. sorokinianum* (summer leaf spot) can also cause severe problems.

Leaf spot severity is determined principally by the turfgrass species or cultivar grown, length of favorable conditions for disease infection and development, and cultural practices utilized. Leaf spot symptoms are generally considered to be expressed by one of two phases. During cool, moist periods (i.e. spring and fall) the leaf spot stage is most evident. While, later when warmer weather conditions prevail, symptoms are expressed by general thinning or melting-out of the turf. The melting-out phase can appear as large irregularly-shaped patches that look like turf suffering from heat, drought stress or both. It should be pointed out that correct identification of the disease problem is extremely important. Usually leaf spot symptoms, crown and root discoloration, are associated with the melting-out phase. If these symptoms are not present, then the turf manager should carefully examine the site for other potential pests that may cause similar effects on the turf such as billbug, sod webworm, or white grubs.

In January, 1980, a Symposium on "*Helminthosporium* leaf spot" was held in conjunction with the 18th Nebraska Turfgrass Conference. The following papers give a contemporary view of the leaf spot problem in turf by discussing disease development and symptom expression, disease management, and development of resistant cultivars. These papers offer the reader an insight into aspects that enhance and discourage leaf spot development; factors that influence the typical disease symptom expression; cultural practices that enhance or suppress disease infestation; and the difficulties involved in selecting and breeding leaf spot resistant cultivars. Turf managers should realize that resistant cultivars are not readily accessible, but that their development takes a considerable expenditure of time and money.

The reader should also be aware that many aspects discussed in the following papers, regarding leaf spot, are also relevant to other turfgrass disease problems in terms of their development, management and manipulation through cultivar improvement. **WTT**

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CONTROL FACTORS OF LEAF SPOT AND THEIR AFFECT ON SYMPTOMS

By Clinton F. Hodges, Professor of Horticulture and Plant Pathology, Department of Horticulture, Iowa State University

Turfgrass pathologists have endeavored to characterize symptoms of turfgrass diseases so that turf managers can diagnose specific diseases and their casual pathogens in the field. Such efforts have served the turf manager reasonably well for the more common diseases. However, increasing knowledge of environmental and cultural factors on disease symptoms continues to provide examples of variation in disease development and symptoms. Variations in disease development and symptom expression induced by environmental and cultural factors can be the cause of considerable consternation. This is becoming evident among species of the genus *Helminthosporium* and especially for *H. sorokinianum Drechslera sorokiniana)*. In time, however, understanding the various effects of environment and cultural aspects on disease expression by *H. sorokinianum* may be used to the turf manager's advantage. The purpose of this presentation is to summarize our knowledge of factors that can modify the symptomatology of leaf spot (*H. sorokinianum*) on Kentucky bluegrass.

Cultivar resistance and time

The use of fungicides is the primary means by which turfgrass diseases are controlled. Resistant cultivars and appropriate cultural practices also contribute to the control of some diseases.

The multitude of Kentucky bluegrass cultivars released in recent years has increased the hope among turfmen that resistance to various diseases will be improved. Resistance to diseases of Kentucky bluegrass induced by species of *Helminthosporium* leaf spot, however, must be approached with caution. Of 30 cultivars grown from seed (and vegetative parts) at the Iowa State University Horticulture Research Station, only five cultivars (Adelphi, Merion, Olymprisp, Rugby, and S. Dakota Cert.) had less than 30% of their leaves infected by *H. sorokinianum* in the spring of their fourth year of growth.

Most cultivars show increasing levels of leaf spot damage with each successive year's growth. In this regard, observations of S. Dakota Certified in subsequent years placed it among cultivars most susceptible to leaf spot.

It seems that the longer any cultivar is grown, the greater the incidence of leaf spot. The pathogen *H. sorokinianum* is a very aggressive parasite that attacks numerous species of grasses ranging from cereals to turfgrasses. The pathogen lives on dead tissue of the lesion it produces on the leaf and may produce a phytotoxin that is responsible for killing leaf tissue. It is very difficult to achieve high levels of resistance in cultivars against pathogens of this type. Under such circumstances, any cultivar that shows less than 30% of its leaves to be infected by *H. sorokinianum* after 4 to 5 years growth may be representative of higher levels of resistance to this pathogen.

Natural selection and observant turf specialists developed the earliest resistant varieties of Kentucky bluegrass for all turf managers.

Leaf age and symptoms

The leaf spot symptoms of *H. sorokinianum* are generally described as starting with small, circular, dark brown to purplish black spots that gradually enlarge and develop tan or brown centers. These lesions also may be surrounded by a zone of chlorotic tissue. This symptomatology is most common on the youngest leaves of the shoot in spring and fall, but such symptoms are greatly modified by progressively older leaves on the shoot.

Kentucky bluegrasses generally maintain 3 to 4 leaves per shoot; the two youngest leaves most commonly show typical leaf spot symptoms, while the two oldest leaves often have enlarged spots accompanied by chlorotic streaking on leaves. Occassionally, a single small leaf spot at the leaf blade base, or at the cut ends of older leaves, can result in the entire leaf turning yellow. Such symptoms on older leaves can be confusing in field diagnosis, particularly if younger leaves show few typical leaf spots. Variations of this type in symptom development have, on occasion, lead pathologists to believe that perhaps different species of *Helminthosporium* were involved. It is known, however, that *H. sorokinianum* can produce a wide range of leaf symptoms that develop in response to physiological age of the infected leaf.

It is becoming increasingly clear that leaf age must be considered in all evaluations of *H. sorokinianum* symptoms. Severity of symptoms produced by this pathogen increase on each older leaf.

Environment and symptoms

Development of *H. sorokinianum* leaf spot on Kentucky bluegrass is markedly influenced by environmental factors. Recent research has es-

tablished that lesion development is influenced by photoperiod and light quality. Individual lesions increase in size on leaves as day length becomes shorter; and, as day length increases lesions become smaller. Under shorter day length, brown to purplish black portions of lesion increases in size as does yellowing that surrounds lesions and complete yellowing of infected leaves is accelerated. Day length also interacts with leaf age; as day length shortens, symptoms become more acute on each older infected leaf.

These observations suggest that leaf spot symptoms should be less severe in spring with increasing day length and more severe in fall with decreasing day length. This is, in fact, a common observation for *H. sorokinianum* on Kentucky bluegrass.

Quality of light reaching infected leaves also can influence appearance of leaf spot symptoms. Infected leaves exposed to increased levels of far-red light have larger lesions and more general yellowing than infected leaves exposed to normal levels of far-red light. As light passes through upper, younger leaves of a plant the proportion of far-red reaching older, lower leaves increases. This phenomenon may, in part, explain why older infected leaves tend to become completely yellow in the fall and early winter. During this time of year shorter daylength and the far-red light reaching leaves will tend to increase the rate at which they age and at the same time increase disease severity on infected leaves.

Effects of temperature and water (rainfall or irrigation) on *H. sorokinianum* leaf spot development are difficult to separate. Leaf spot is most active during the cool periods of spring and fall. As temperature (possibly combined with wind velocity) increases and rainfall decreases in summer months, number and size of leaf spots decreases. However, our field studies have shown that if the summer is relatively wet, or if irrigation is provided, leaf spot may occur on 13 to 60% of leaves throughout summer months depending on susceptibility of the cultivar. Midsummer leaf spot seems to be more closely regulated by moisture than by temperature.

Cultural practices and symptoms

Nitrogen fertilization often increases the severity of *H. sorokinianum* leaf spot on Kentucky bluegrass. When nitrogen stimulates leaf spot it is usually reflected by an increase in size of lesion and by some general yellowing of infected leaves.

Studies recently completed in our laboratory indicate that nitrogen and leaf age interact to influence leaf spot severity (i.e. the youngest leaves of nitrogen fertilized plants may have less disease than those of nonfertilized plants, but disease is increased on the oldest leaves by nitrogen fertilization). This suggests that the subject of nitrogen fertilization and leaf spot severity is related to the physiological age of leaves and that influence of nitrogen on disease may be modified by leaf age.

Herbicides represent another cultural tool that shows some potential for influencing severity of *H. sorokinianum* leaf spot on Kentucky bluegrass. Such commonly used herbicides as 2,4-D, MCPP, and dicamba may enhance leaf spot development. Like other environmental and cultural factors that enhance leaf spot, leaf age is directly involved in the interaction. Increase in diseased tissue on youngest leaves is minimal and severity of disease increases on each older leaf. In some instances, one small lesion on an older leaf of a plant exposed to MCPP or dicamba can result in a rapid straw-colored blighting of the entire leaf. It is believed that auxin-like herbicides (2,4-D, MCPP, dicamba) may increase the rate of aging in older leaves and predispose them to more severe disease.

Nitrogen and leaf age interact to influence leaf spot severity. Some herbicides enhance development of leaf spot as well.

Seasonal appearance of leaf spot

It is now known that leaf age, environment, and cultural factors can influence severity and appearance of *H. sorokinianum* leaf spot symptoms. On the basis of these observations, it is of interest to speculate on how these various factors might influence leaf spot during the various seasons of the year. The following outline is a speculative summation of how leaf age, environment, and culture practices might interact with leaf spot.

Spring

A. Appearance of Symptoms

1. Leaf spots small in early spring.
2. Leaf spots larger with some leaf yellowing in mid-spring.
3. Leaf spots smaller by late spring to early summer unless irrigation is provided.

B. Factors involved

1. The rapid flush of leaves in the early spring results in a very youthful shoot which inhibits leaf spot development. By mid-spring normal senescence of leaves on individual shoots has increased and such leaves show the larger lesions and the more severe yellowing symptoms.
2. By late spring increasing day length and reduced moisture levels (assuming irrigation is not provided) results in fewer leaf infection and less severe infections.
3. Applications of nitrogen or herbicides (auxin types) between mid-spring and early summer could increase severity of leaf spot. However, it is also possible that

Continues on page 62

"Saved money."
Jim Anderson, Lost Spur Country Club
St. Paul, Minn.

"Controlled brownpatch."
Larry Bunn, Blue Hill Country Club
Canton, Mass.

"3 week control."
Chris Myers, Bloomfield Hills Country Club
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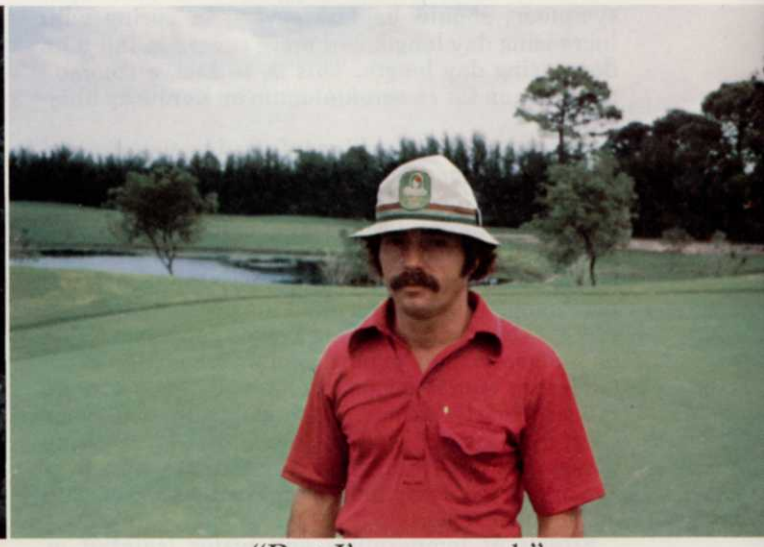

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DISEASE MANAGEMENT IS BASED ON FIVE GENERAL AREAS OF EFFORT

By W.C. Stienstra, Associate Professor and Extension Specialist, Department of Plant Pathology, University of Minnesota.

In plant pathology disease control, I prefer the term Disease Management. Disease management is based on five general methods or traditional areas of effort.

First, resistant lines: this is and has been a major form of plant disease control or management with all plants. It is depended upon for disease control or management in crops such as cereals, corn, beans, hay and many others. In many of the more intensive crops, disease resistance is necessary to manage and produce even with the use of fungicides. The introduction of leaf spot resistance (i.e. Merion Kentucky bluegrass) changed the turf world. Today's term is "a revolution occurred." Resistant plants are, I believe, the "natural state" and we should (1) do all we can to utilize genetic material and (2) provide favorable environments for plant growth to express genetic potential.

Pathologists in general and myself specifically have not involved themselves to the extent they should in defining optimum conditions for turf growth.

The second general method of disease management is exclusion (i.e. quarantine). The best known quarantine for plant disease is at international ports of entry where ships, planes, cars, trucks and people are crossing from one country into another. Quarantine is also accomplished on a smaller scale as in foundation seed, commercial greenhouses, and many other cases where valuable stocks and certain crops are grown in confined areas with good sanitation procedures.

In turf leaf spot management, exclusion or quarantine has limited value.

The third general method is eradication (i.e. the attempt to remove the disease organism after it has entered an area). This is very difficult on a field scale once the organism has become established. However, in some confined areas this can be accomplished. The profits obtained from such a program often are quite high. This technique again has limited use in turf leaf spot management.

The fourth general method is sanitation, a term meaning clean up of an area to reduce chances of infection. Persistence of the individual plant manager in watching and using all procedures makes the difference between success and failure. This is important in turf leaf spot management.

The fifth general method is protection, the use of chemicals (i.e. fungicides). There may be too great a reliance on chemical protectants since they are easily used, readily available and response is expected where disease threatens. Fungicides are needed in disease management and are very useful in turf leaf spot control.

The five general methods of disease management are resistance, exclusion, eradication, sanitation, and protection. What management factors should the turf managers use when developing practical methods of leaf spot management in turf? *Helminthosporium* Leaf spot is one of the most common and serious disease complexes attacking cool season turfgrasses in the U.S. Leaf spot can be very destructive during wet humid weather or in areas where the turf is sprinkled frequently especially in early evening. The more often grass is wet and the longer it remains wet, the greater are the chance of disease. *Helminthosporium* fungi are responsible for the gradual browning, thinning and melting out of Kentucky bluegrass cultivars and other susceptible grasses. As the disease progresses, large irregular turfgrass areas are yellowed, browned and finally killed. Once *Helminthosporium* fungi become established in a turfgrass stand, they remain an ever present problem.

The disease cycle of all species of *Helminthosporium* fungi is essentially the same. They survive from year to year as mycelium in dead grass tissues or in infected leaves, crowns, roots and rhizomes. Under moist conditions, tremendous numbers of spores are produced on this debris and carried to new leaf growth by air currents, mowers and foot and vehicular traffic. The spores germinate in a film of moisture and infect the leaves. Spore germination and infection of leaves can take place within a matter of hours when conditions are favorable. New spores are produced on these infected leaves within a few days which in turn spread to new leaf parts and neighboring plants. Thus the cycle is repeated. New leaf infections may occur as long as conditions remain moist and the temperatures are favorable for germination and growth.

Best management of leaf spot begins by providing an adequate soil zone for turfgrass root growth.

Best management of *Helminthosporium* leaf spot begins by providing an adequate soil zone for turfgrass root growth. Turf areas developed with planned surface drainage and adequate internal drainage will produce a vigorous network of plants (leaves, roots and rhizomes). Plants growing under these conditions will respond best to adverse environmental stresses.

When managing to prevent disease problems, it is important to remember the disease formula (i.e. you must have the host, the causal agent and a favorable environment for disease to develop). A vigorously growing plant is best suited to express its genetic resistance and to survive the period of disease stress and to recover faster.

Best management of *Helminthosporium* leaf spot continues with the selection and use of resistant

varieties. Leaf spot resistance in the form of Merion Kentucky bluegrass so changed the turf industry that now we recognize other summer diseases of turf. Before Merion, summer disease problems were always caused by *Helminthosporium*. *Helminthosporium*-incited diseases rank among the most important fungus disorders of turfgrasses. Characterized by leaf blighting, leaf abscissium, root, rhizome, stolon and crown rots, it is not uncommon in certain seasons for this group of diseases to become the limiting factor in turfgrass production.

The best control of *Helminthosporium* leaf spot is obtained through the use of resistant varieties. Many lines exhibit nearly complete resistance to *Helminthosporium* under field conditions. Select high quality, disease resistant seed or sod that is locally adapted or a mix of locally tested grass varieties resistant to one or more *Helminthosporium* diseases.

But what if you already have a turf area, and do not want to begin a major rebuilding program? What should you consider in a *Helminthosporium* leaf spot sanitation program?

First - mow the bluegrass or for that matter, rye and fescue at the recommended height. *Helminthosporium* leaf spot is most damaging when close mowing occurs, so avoid close clipping at all times and especially when the leaf spot stage is a serious threat and when conditions are favorable for disease development. Mow the grass frequently, removing no more than one third of the leaf surface with a single mowing. Removal of clippings may further reduce the available food base for *Helminthosporium* leaf spot development.

Second - water turf areas as needed, wetting the soil to a depth of 4-6 inches. Repeat every week if nature does not supply adequate amounts. Apply supplemental water during or immediately after light showers during any dry periods. The value and importance of the soil can and should be noted here. Soil that is slow to wet and soil that has an inadequate water holding capacity forces you into frequent light sprinklings, and water-logging the soil surface, which promotes disease development.

Third - fertilize based on soil tests and nutritional needs of the plant. Avoid heavy applications of water soluble fertilizers, when *Helminthosporium* leaf spot disease is expected. Fertilize to maintain a uniform level of soil nutrients in the root zone, following the local recommendations for the grasses being grown. Consider fertilizer needs beyond having the greenest turf in the area.

Fourth - reduce thatch accumulation or mat to less than one centimeter by using a power rake or an aerifier. These operations are usually accomplished in the spring, fall or both when turf growth and recovery are rapid for cool season species. Thatch reduction is a process not completed in one treatment, just as thatch accumulation occurs over the entire growing season. Management of thatch accumulation and its removal is needed in most turf areas.

Development of resistant lines
is a major form of plant disease control and utilizes known resistant material

Fifth - consider modifying the local environment. Is the turf growing under dense shade, in areas with restricted air movement? Could trees or shrubs be removed or pruned? If so, will more light penetrate to the turf and will greater air movement over the turf speed the drying process thus reducing disease conditions?

Sixth - If *Helminthosporium* diseases are not adequately managed by cultural treatments, fungicide sprays may be needed on a responsive-preventative schedule. A responsive - preventative schedule means fungicide applications begin with the development of the disease and continues every seven to fourteen days during the period when conditions permit disease development. This spray program requires disease awareness, disease diagnosis, time, money, and for the average individual may not be practical. If only a few sprays will be applied, to be most effective, most of the time, the applications should occur in the spring, fall or both when cool wet growing conditions are common. If spraying is delayed until leaf blighting is severe, or thinning is obvious, the results will be poor.

Spraying fungicides or "all the world loves a universal green paint" is the "take two aspirins and call me in the morning" philosophy. Spraying, the easy, accepted, and indeed expected disease response, often may not be well understood. We can cite chapter and verse on preventative schedules, curative schedules, manufacturer directions, package label rates, application intervals, compatibility, safe use, pressure, volume, time of day, uniformity, nozzles, nozzle spacing, temperature, moisture, grass condition, grass potential, chemical persistence, spreaders, stickers, rainfall, past fungicide use and resistant isolates.

Continues on page 62

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Management *from page 59*

Fungicide disease control basically involves products that are (1) lethal to the fungus, or (2) inhibit fungal germination, growth or multiplication. Some fungicides are "broad spectrum", inhibiting a wide range of pathogens and other are "narrow spectrum", having a specific activity for only a few fungi.

Helminthosporium leaf spot fungicides prevent infection by the fungus rather than cure the disease. Thus effective fungicide control occurs only on plant parts to which fungicides are applied and only for the period fungicides remain on the plant. Contact fungicides must be applied at regular intervals to maintain protection on turfgrass leaf surface. Since control is achieved by a protective coat of fungitoxic chemical on the plant surface the fungicide must be applied uniformly. New, unprotected shoot growth is constantly being formed within the turf stand. These limitations must be recognized whenever you use fungicides to manage plant diseases. Certainly fungicides do help in a turf leaf spot management program but they will not replace a poor leaf spot management program or substitute for no leaf spot program at all.

In summary, of the general disease management methods, three are suitable for *Helminthosporium* leaf spot management consideration. These are resistant lines, sanitation and protection, while exclusion and eradication have limited value. The guts of a leaf spot management program is proper cultural management. Turf managers where *Helminthosporium* leaf spot is a threat should consider the effects of modified mowing, watering, and fertilizing practices. Further, they should consider de-thatching and if needed, modifying the turf environment. Lastly, apply fungicides as needed. If the results of these efforts are unsatisfactory, renovate by over seeding with resistant cultivars or reestablish completely including necessary soil and site preparations. **WTT**

Factors *from page 53*

early spring application nitrogen and auxin-like herbicides might temporarily retard leaf spot symptoms by promoting youthfulness in rapidly growing leaves.

Summer

A. Appearance of Symptoms.

1. Minimal appearance of small leaf spots under a normal, relatively dry summer environment.
2. Moderate to heavy leaf spot symptoms during wet summers or with irrigation.

B. Factors Involved.

1. Increasing day length and temperature, and reduced levels of moisture would normally reduce invections and decrease disease development on individual leaves. These factors would keep leaf spots relatively small.
2. Excessive rainfall or irrigation during summer will compensate for higher temperatures and increase infections. Applications of nitrogen and herbicides under these circumstances would further enhance disease severity. Some preliminary evidence suggests that high temperature stress combined with nitrogen and (or) herbicides may greatly enhance leaf spot symptoms on irrigated turf during the summer months.

Fall

A. Appearance of Symptoms.

1. Early fall number and size of leaf spots increases.
2. Late fall to early winter leaf spot symptoms become severe, including yellowing and blighting of entire leaves. Turf may appear to have a yellow undercover.

B. Factors involved.

1. Increasing moisture, shorter day lengths, and lower temperatures increase number of infections and enhance senescence of leaves. Enhanced senescence predisposes leaves to more severe disease development.
2. By late fall and early winter decreasing day length becomes a primary factor in enhancing leaf aging, and older infected leaves respond by blighting.
3. Nitrogen applied in late summer or early fall may have some delaying effect on senescence and for a period slow yellowing of older infected leaves.
4. Late summer to early fall applications of herbicides may enhance yellowing of older infected leaves by increasing the rate at which the leaf reaches senescence.

Winter

A. Appearance of Symptoms.

1. No leaf spot symptoms on dormant grasses. Winter may be the most important season for fungal colonization of dead tissues.
2. Grasses remaining green under snow cover and especially unfrozen soil will continue to show leaf spotting, yellowing, and blighting typical of late fall.

B. Factors Involved.

1. Provided adequate moisture is available, mycelium will grow slowly down to 36 degree F. Such growth could be important to colonization of dead tissue and an increase in spore production the following spring.
2. The potential availability of nitrogen, especially slow release forms, during winter months could provide an important nutrient source for pathogens and aid colonization of dead tissue.
3. Kentucky bluegrass will often remain green under snow cover, especially if the ground is unfrozen, and if nitrogen fertilizer is applied in the late fall. Under such circumstance leaf spotting and yellowing will persist as long as temperatures are 36 degrees F. or above.

PLANT SELECTION, HYBRIDIZATION PRODUCE NEW VARIETIES

By Gerard W. Pepin, Research Director, International Seeds, Inc., Halsey, OR

Starting with Merion, many leaf spot resistant cultivars have been developed. Almost all of the new bluegrass releases have good leaf spot resistance. The nature of the genetic resistance is not known. The resistant cultivars are generally low growing, broad leaved plants while the susceptible varieties are usually tall growing, fine leaved, stemmy types.

A number of fungicides can be used to control *Helminthosporium* leaf spot. Some of the better known broad spectrum fungicides commonly used are Actidione Thiram or TGF, Daconil 2787, Dyrene, Kromad and others. Unfortunately, fungicides are expensive and time consuming to apply. The best control is the planting of leaf spot resistant cultivars and there is a long list to choose from. However, under severe conditions, even the genetic resistance of the best cultivars can break down and fungicide application may be necessary.

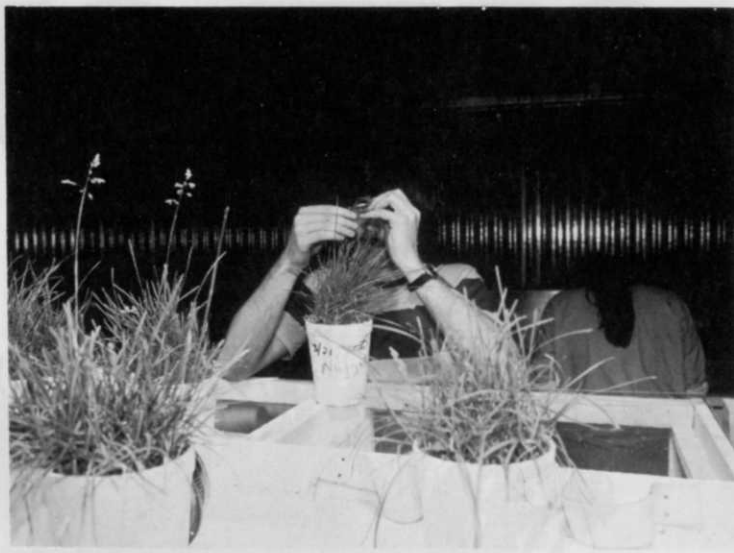
Plant breeders have been very successful in developing leaf spot resistant varieties. Two basic techniques have been used in bluegrass breeding: plant selection and hybridization.

Plant selection is the most basic breeding technique in existence. It simply involves the selection of superior plants that occur naturally, prosper and spread under close cut turf conditions. Often these plants can spread to enormous size; the plant selection that became Touchdown was over 50 feet in diameter. Some of the better known plant selections are Merion, Baron, Fylking, Glade, Windsor, Victa and Parade.

Bluegrass hybridization is a much more recent breeding technique. It has only been used for the past ten to 15 years but has resulted in the development of a number of improved leaf spot resistant varieties such as Adelphi, Bonnie-blue, Bristol and Majestic.

Hybridization is difficult in Kentucky bluegrass due to its unusual type of reproduction and seed formation. Kentucky bluegrass is facultatively apomictic, which means that most of the seed it produces bypasses the normal sexual reproduction cycle of grasses. This seed is an identical genetic copy of its mother plant. Only a small percentage of seed produced will be genetically different from the mother plant.

From a breeding standpoint, this unusual type of seed formation is both good and bad. It is good in that exact duplicates of superior plants can be produced year after year with no variation and no danger of losing a variety due to genetic shift. It is bad in that crossing is quite difficult because few hybrids are produced. Most of the seed derived from crossing will be identical to the mother plant and thus useless to a breeder. For every 1,000 plants derived from a cross perhaps only 20 to 50 hybrids might be produced. Since only one of a thousand hybrids might show commercial promise, huge numbers of plants have to be grown from seed produced by crossing two parent plants.



Seed research entails huge numbers new crosses to study for resistance.

Kentucky bluegrasses are usually crossed in the greenhouse during the spring. In the summer the crossed seed is germinated and individual spaced-plants are set out in the field. The next summer the mature plants are observed and the hybrids identified. Seed of the best appearing hybrids is harvested, cleaned, and used to plant a small turf plot of many standard varieties and the new hybrids are carefully compared with the check varieties. The resistance to various types of *Helminthosporium* leaf spot and melting-out of the hybrids is closely observed. It is essential that new hybrid variety intended for fine turf use has good leaf spot resistance.

The success rate among new bluegrass hybrids is very low. Perhaps only one in 500 or 1,000 hybrids will combine the characteristics of good turf quality, good disease resistance and good seed production necessary in new, improved varieties.

Despite the difficulties, several active bluegrass breeding programs are continuing in the U.S. and Europe. It is from these programs that a continuing source of new varieties will be forthcoming. The perfect variety will never be achieved, but hopefully breeders can keep developing varieties that get closer to that ideal. **WTT**

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OUTMODED FOUNDATION PLANTING HAUNTS LANDSCAPE DESIGN PROGRESS

By Fred K. Buscher and Jot D. Carpenter, area extension agent in horticulture and chairman of the Department of Landscape Architecture respectively, Ohio State University.

Foundation planting is a landscape term which has been used for more than 60 years to describe a method of planting around the base of buildings. Before the turn of the century, foundation plantings were called base plantations, and later, base plantings. These plantings were designed to overcome the rigid architectural styles of the era and provided a more harmonious transition from the lawn to the base of the walls of the building with plants arranged in a natural manner.

The origin of the term "foundation planting" is difficult to document, but references to it can be found in articles on landscape gardening as far back as 1914. Plants have always been used near buildings, but planting a row of shrubs (deciduous or evergreen) in a straight line across the front of a building is a comparatively recent American idea. This practice has been condemned over the last 30 years as no longer necessary. Foundation plantings are criticized today when used in an eclectic manner instead of part of the landscape design of residential properties.

Unfortunately, the expression "foundation planting" has become so popularized by the horticultural press and landscape industry that planting the front of a house is one of the first considerations of the new homeowner. Consequently, much of this is overdone today. The problems of the foundation planting in today's landscape are still very real, as they were in 1900.

Many of the books written on landscape and garden design before and after World War I made an appeal to make the country more beautiful. The objective of these landscape books was to help in the artistic development of the home grounds of the suburban and moderate-size city lot homeowner.

There was little reference to landscape planning for the small city lot residential property where most of the people lived. Information for the small home gardener could be found in the garden magazines or larger homes in the city and suburbs could be used as models.

Another purpose of the garden design books was to provide horticultural information for those in the landscape business and those with a desire to know more about the beautification and improvement of their properties. Many persons engaged in the landscape industry today either grew up on a farm or lived in a small house on a narrow city lot with little planting.

Writers at the turn of the century recommended using more plants about the foundation area of the house. H. Kellaway, an early writer, suggested that most buildings would look bold and bare if they did not have some plants at their base. Plants would soften the sharp line and create a softening effect so the building would appear as part of the total landscape composition.

Base plantings were criticized before the turn of the century. One writer warned to avoid the overuse of shrubs. The house should not look as though it grew out of a thicket or that the cultivation of shrubs was the owner's chief concern.

European influence on architecture following the Civil War, such as Victorian style (top), and the warm air furnace encouraged use of foundation planting. Misuse of foundation planting (bottom).

Instead, the late 19th century writers suggested the massing of plants in the angles of porches, steps and bay windows. To avoid the straight rows of plants, garden designers even suggested breaking

Foundation *from page 65*

the plantings, allowing the foundation to be seen resting on the grass giving a semblance of stability to the house.

By 1922, foundation planting was well entrenched in landscape vocabulary. One definition of the term included: groups of shrubbery located along the base of a building. The objective of the foundation planting was to hide unsightly walls, soften the hard lines of the architecture, provide some measure of privacy, and unite the building with the ground. Some of the terminology is still used today to justify foundation planting, such as: to tie the building to the ground, to soften it, and to conceal scars. Landscaping the front of a house with a row of shrubs was highly criticized for not improving the appearance of the house. Instead the emphasis was always on irregularly massing shrubs at the corners of the house.

No base planting was considered necessary for houses which were set close to the ground. In this event, the lawn could extend up to the lines of the porches, but group plantings should be massed at the corners of the house. When enough of the foundation showed above grade, Gridland suggested that only dwarf plants should be used and larger types placed at the corners and in the blank spaces between windows. There was always concern not to plant in front of a window as this would interfere with light and ventilation. Garden designers urged that base plantings should have curving lines and to avoid the monotous rows of shrubs. The lines of the planting beds should extend out at the corners and recede into the face of the building. Both tall and low growing plants would add to the effect of this method of base plantings.

Going further back in history, there was little concern by the average homeowner over extensive landscaping plans. For example, before the Civil War, the front yards of the smaller houses were usually only 6 to 10 feet deep. Some of the larger houses were set back from the street. Most houses had fences for protection from livestock running at large. A visitor to New York in 1850 complained that pigs rooted in the gutters and that cattle were herded in droves through the streets.

After the Civil War in America, changes began to occur in architectural style and residential construction which had some effects on the types of landscape planting. The expression "front yard" was used to describe the area around the house open to the public view. The term was not the most appropriate, but at that time, a garden was considered a place for vegetable or flowers to be kept out of public view in the back.

The picket fences started to disappear from the American landscape scene as pioneer conditions

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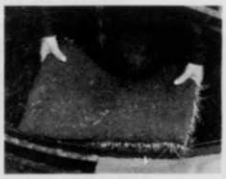

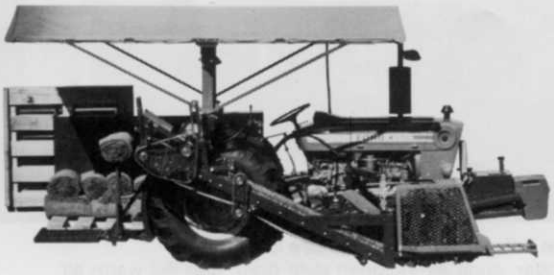

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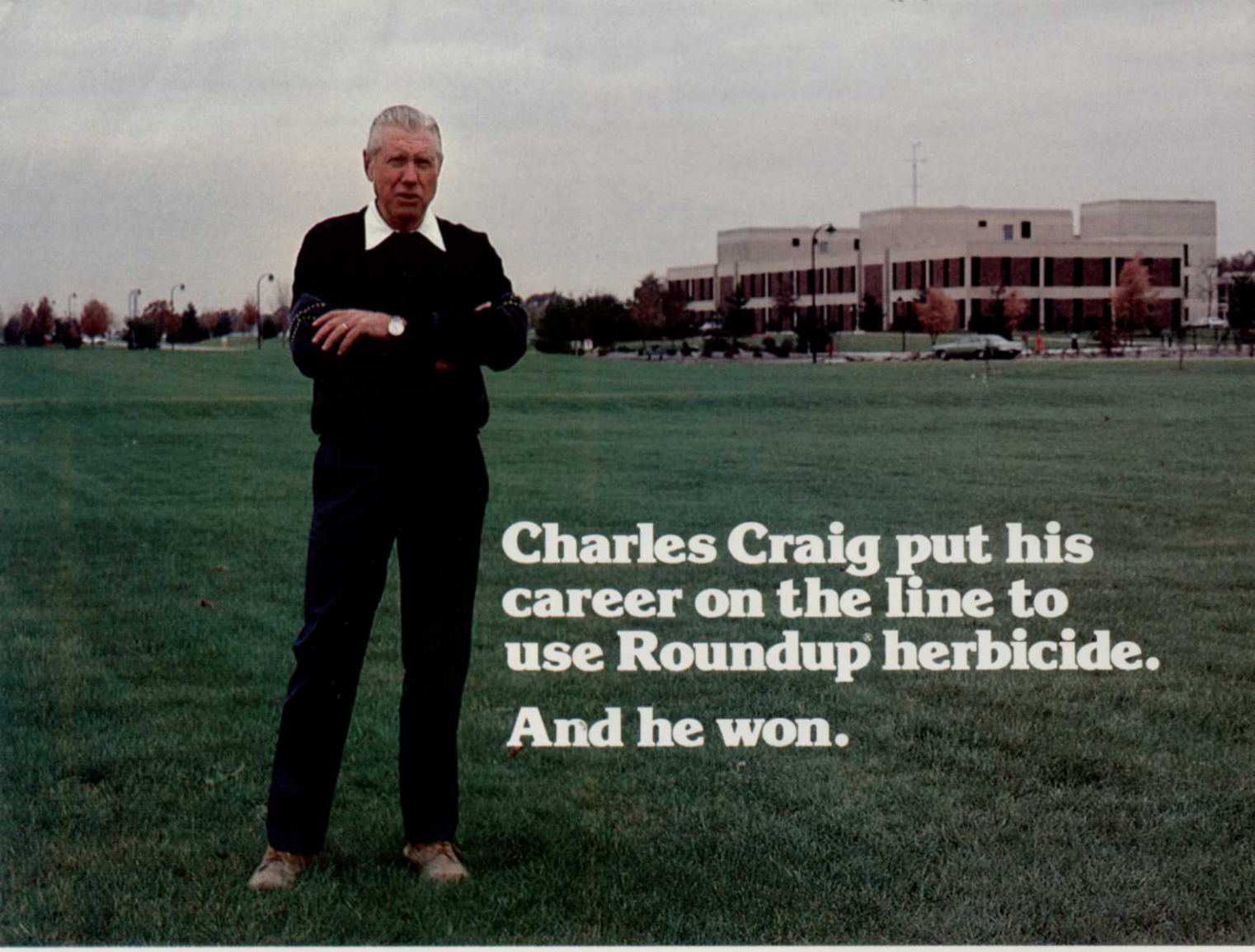

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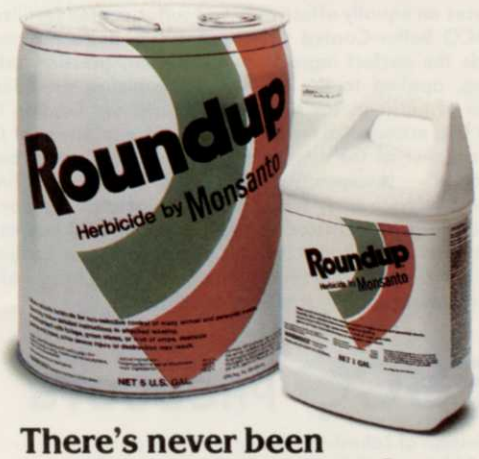

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Foundation *from page 66*

began to fade, although some fences remain to continue the customs. Houses were set further back from the street with larger, more open and showy front yards. It was during this period in American History that the front yards became a major feature in residential landscape design. The habit of living in the garden, as was also the custom in England and Europe, began to decline in America, and with it, the need for privacy in the front and back yards was less important.

Between 1850 and the early 1900's the influence of Andrew Jackson Downing and his followers dominated American landscape design and thought. They advocated the so-called natural style of landscape planting of the larger estates and parks. This involved curving drives, walks, and isolated planting beds, at times placed without good reason. The natural style featured several exotic ornamental trees or shrubs in the front yards such as the copper beech and weeping birch. Later, the electric blue spruce was a front yard feature. Even shrubs were planted as single specimens or in beds in the front lawns. Later, the native plants began to replace the exotic European specimens once considered to be more important.

The end of the Civil War brought an end to the Greek and Roman revival style of architecture in America. Architects and builders began to experiment with the Gothic, the Egyptian, the Romanesque, the Byzantine, and the contemporary French. Out of all this, a Victorian style developed.

This was also a time when new materials, new tools, and manufacturing processes became available to the builders. Low-cost steel replaced handwrought iron. The manufacture of Portland cement boosted brick and masonry construction. Plate glass manufacture was industrialized. Wood was the most abundant building material of this time. There were new power tools to cut, turn, twist, and shape the wood into the symbols of the Victorian period.

The European influence on residential architecture began to show up in the homes of the newly rich after the Civil War. This was considered the darkest period of American residential architecture. It was the time of the pseudo manor, Victorian, Gothic and French Mansard along with beds of geraniums and cannas, iron deer, and open lawns. At the close of the century, authentic revivals of architecture began again and brought an end to the excesses of the Victorian age with improved domestic architecture.

The custom-built houses with high foundations occured about the same time houses were placed further back from the street and set in an open lawn. Thus, the planting of shrubs and vines next to the base of the house and porches began, and foundation plantings became the style. In those years, such a foundation planting was deemed necessary to hide the foundation and otherwise soften the break between the house and lawn.

Another fact that contributed to the building of exposed basement foundation walls was the new concept of central heating and introduction of the warm air furnace. The basic heat sources before the gravity warm-air furnace were steam or hot

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Foundation *from page 69*

Civil War era home without porch,or tall foundation, or base plantings.

water. The warm-air furnace was the least expensive to install, and by 1894 was a fairly well developed basic source of heat in houses. The hot-air furnace was installed below the rooms to be heated requiring a relatively deep basement.

To reduce digging to make sufficiently deep basements, some foundations were laid at ground level, or a little below grade. The excavated soil was terraced against the exposed basement wall. High foundations were not always considered problems. It was considered much better to have a shallow basement than one dug too deep, as the height could be overcome by planting at the base of the house when there was sufficient soil for the fill.

Porches also had influence on the foundation planting. The trend for out-of-door living after the turn of the century brought about another change in house design. It caused architects to complain that porches were the greatest trial they had. The porch was absent in the homes of early America, England, and France. By the 1920's, the typical house was the two-story "packing box" cube with a porch across the front. This was one of the most difficult houses to plant successfully. With this type of building, the landscape designers were justified in suggesting a foundation planting where previously it would have been condemned.

Although the steam heating system was first developed by James Watt in 1770, a major drawback in its development was high cost and a lack of trained fitters in the smaller towns and villages to install the system. The hot water system paralleled the development of the steam system, and by the early 1900's, both heating methods were used in residential and commercial buildings in addition to the less expensive gravity warm-air furnaces. With this system the leader or warm air round pipes radiated out from the top of the furnace to the first floor registers and second floor stacks. Leader pipes and cold-air return ducts were designed to be short and direct, necessitating the large furnace to be placed in the center of the basement.

The long front porch was not a family center of activity, but reserved for afternoon, good clothes, gossip with the neighbors, and a place where the ladies did their hand sewing. The porch was also an outgrowth of the social needs to observe the passing scene of the neighborhoods daily life. Most porches were ugly from an architectural standpoint and difficult to add to a well designed house. The houses which are the most pleasing visually have stoops but no porches. Front porches are a part of the passing scene today. However, the plants which once were used to hide the open porch railings and lattice work between the supporting posts of houses of that architectural style still exist. This type of "left-over" foundation planting across the front of most residential houses today serves no real purpose.

When the trend for privacy and garden living again became desirable, the porch was moved to the side or rear of the house in conjunction with a patio. A new mode of landscape design slowly began to develop about 40 years ago when gardens and the landscape were suggested as places to be lived in, rather than looked at.

Authors such as Waugh, writing in the 1920's, show there is still tremendous agreement among today's authors with many of the principles in the older books and articles on landscape architecture and garden design. Careful consideration of the basic principles of good design and approaches to solving environmental problems used in the 1920's show that only the styles of the language and vocabulary have changed. The directions for the development of the small home grounds, however, were written primarily for the well-to-do owners of larger properties in the city or suburbs.

The landscape architects, gardeners, and writers played a major part in the landscape improvement of the communities during the 1930's but their suggestions were beyond the reach of the majority of Americans who lived in small houses on narrow city lots, on farms, or in small towns and villages. Much of the gardening information for the "average" American was obtained from the garden magazines where the original source of information came from the garden and landscape books. The pattern for landscape designs of the small houses was copied in a selective manner from the larger homes, but without the changes necessary due to scale and site differences.

By the early 1930's many of the people in the towns and cities of the United States lived in multi-family dwellings. From the time when foundation-plantings were used to cover the exposed masonry of houses and up to and beyond the middle 1930's, the average American lived in small houses. The characteristic of the small urban home is compactness in high density population. The houses were most often two-family. Single houses were on narrow lots of 35-50 feet wide and 100-150 deep. These properties had small front and back yards with a minimum of space for gardens and shrubs.

Continues on page 72

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Foundation *from page 70*

The suburban home of this period was set closer to the ground with less foundation showing on a larger lot of 7,000 or more square feet. These suburban homes had a great deal of planting area around them with room for flowers or vegetable gardens in the rear. The American suburban home of the mid-thirties had a wide variety of modern architectural planning and design features comparable with most of today's houses except for the split-levels. The exterior architectural appearances were varied and derived from a great number of styles such as English, Colonial, Spanish, Georgian, or a mixture of these in an American Style.

Most of the circumstances which led to the development of the foundation planting as described in the preceding paragraphs have changed, but the practice of planting the front of houses lingers on. In general, the high foundation is gone from today's houses, but the planting is still there. This method of planting does not meet today's need. However, it is a custom that will die slowly with the landscape nurserymen and home gardener. Eckbo, in his book Landscape for Living, stated: "Foundation-planting; that great technique for moving miscellaneous nursery stock purports to 'tie the building to the ground, soften it, conceal the scars,' etc." Landscaping is very apt to be sold as beautification which may cover up damage to nature or mistakes of architects or builders.

The professional literature has been full of references that criticize the concept of the foundation planting. In 1935, Bottomly wrote: "The continous foundation planting is wrong mainly because it is overdone and because the connecting plants are so high and so positive as to destroy the effect of the functional plants at the entrances and corners." Writers on landscape, in general, have said the only reason for any form of foundation planting should be used to soften the lines of the building and help blend the building into the surrounding landscape.

One way suggested to focus attention on any fault in a foundation planting was by taking a picture of the front of the house, framing it and hanging it over the fireplace. If something was wrong, the problem would show up easily, since, generally, tall shrubs should be planted at the corners of the house to soften harsh lines and create a transition to the landscape and some accent be made at the doorway. The old practice of accenting the doorway was simply to plant six spireas each side of the front door.

Landscape architects writing for the benefit of the home gardeners mentioned there were more poor examples of foundation plantings in America than any other type of planting. They were critical of the many reasons given for using foundation plantings such as fitting the house to the surrounding area, or harmonizing the vertical lines of the building with the horizontal lines of the ground. Other reasons listed to justify foundation planting were to soften the lines about the house or to accentuate or decorate. These were all worthy purposes, but the landscape critics questioned how much softening or harmony there was in the monotony of stiffly spotted evergreens or

Porches moved to the side or rear of the house, but the plants remained as before.

deciduous shrubs planted around a building. One recommendation was to forget about the foundation planting entirely as the major reasons for its existence had passed into oblivion. What it does is set the house on a ruffle of fluffy foliage, or if the plants have been sheared the house sits on an Alice in Wonderland set of machine-like cubes, spheres, and pyramids.

In any discussion on the good or bad features of foundation plantings, it is the house which must be considered the most conspicuous object in the landscape. Plants are one of the elements in the landscape that best create the harmony between the ground area and the building. The foundation area is where plants can be located to create this harmony.

There is no reason to completely encircle a house with a continuous mass of shrubbery unless the house has an ugly foundation. High foundations of stone or brickwork are often attractive, at least in part, and can add a pleasant view if made visible. With today's architecture, whether modern or traditional in style, standard construction brings the facing material (wood, brick, etc.) to within 6 inches or so of the ground, showing little or no foundation, so there is even less need for foundation planting.

The criteria for a good foundation planting may be that it should never call attention to itself; felt, but not necessarily noticed, so that the facade of the house will be accented to harmonize with the entire landscape development. Too often the opposite is seen where the foundation planting becomes a collection of plants with different shapes, contrasting textures, exotic colors of foliage and flower, as though the plants are being grown for the sole purpose of cultivating a small arboretum.

The foundation planting should not be treated as a separate unit of the landscape, but as part of the entire house and garden design. Perhaps it would be better to forget about the foundation planting and consider the overall setting of the house, its background and foreground, and the ground area as one unit. When this happens, the plantings about the walls of the foundation will be less prominent, with fewer varieties and quantities of plants, so that attention is directed to the house rather than the planting. Today, houses have attractive walls that can be enhanced with shrubs, not concealed, and the landscape is supposed to be lived in, not just to be looked at.

The contemporary approach to foundation

planting is to treat it as part of the total planting design, not as a separate unit. At one time, plantings in front yards were designed to be viewed as a picture to be seen while walking or traveling by in a car or carriage. Today, the front yard should be considered, not as a picture, but rather as a space for people to use — a part of the entry to the home.

Some authors have suggested a number of simple rules as guides in solving design problems of the foundation planting. These rules included planting corners; doorways of the home; suggestions on shapes, widths, and lengths of planting beds; and selection of plants to fit the building and environment. (How do you design a set of rules that can apply to all styles of architecture and house?)

Part of the problem we have today in residential planting design is the application to all types of architecture of a concept developed years ago for a single type of architecture. We no longer build houses with high foundations, but the same type of planting is still placed in front of colonial, cape cod, (which authentically would have no foundation planting) ranch, or split level houses.

The use of plants in foundation planting to create a transition from the building to the ground or to accentuate, decorate, and soften the harsh lines about the house, etc., have been primarily thought of as the artistic part of planting design one of simplicity, scale relationship, balance, sequence, and focalization.

More important is the functional role of plants to solve environmental and aesthetic problems in the landscape. Contemporary planting design uses the functional spectrum of plants which includes architectural, engineering, climate control, and aesthetic use of plants.

Architecturally, plants can be used to form walls, canopies, or floors by taking advantage of their different growth habits and foliage characteristics. They can be used to define or articulate a space, provide privacy, screen an unpleasant view, or reveal or frame a significant view or object.

Plants used for engineering purposes can reduce the glare of lights, or create a better traffic pattern for movement of people and cars. The engineering spectrum of plants can also include sound control, air-conditioning, and erosion control to mention just a few.

The climate control spectrum might use deciduous shade trees to screen the hot sun or in winter, to permit the sun to penetrate to the ground. Plants used in climate control can act as windbreaks, increasing or decreasing wind velocities and directions, can reduce the impact of precipitation, and can change solar radiation levels.

Continues on page 75

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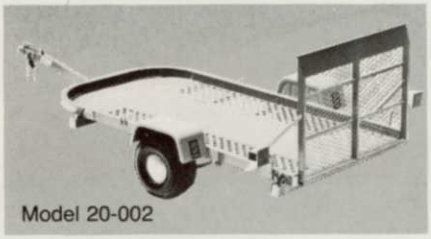
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Foundation *from page 73*

Plants have been used traditionally for beautification (aesthetics). This has unfortunately been considered the major or only reason for plantings around buildings by most people.

Aesthetically, plants can become a piece of living sculpture, as when placed against a wall to give an interesting shadow pattern of branches. They can be used as a background for other plants, or to help blend together unrelated objects, buildings, or structures. They provide an environment for birds and wildlife and enhance our surroundings. An important aspect of aesthetics often overlooked is the impact on senses other than sight - smell - touch and hearing. Examples might be the sound of the winds in the pines, the scent of a linden grove in spring or the feel of new clover on a sunny hillside.

An alternative to foundation planting can be to design the front yard as a public access area in such a manner that visitors or family pass from the public street to a doorway garden designed to suggest a degree of enclosure and a sense of arrival. The passage from street to door can be through trees, shrubs, fences, hedges, flowers, and over surfaces of pavement, grass or ground cover designed as a door-yard garden providing a feeling of separation from the street to the privacy of the home and all in the name of foundation planting.

The planting for the front yard becomes an extension of the entryway of the house and in some ways part of the living room. It is at the point of entering the lot or front yard where the preparation begins for the social interchange which later takes place within the house. For example, in years past, some religious shrines were located within a beautiful woods setting. The walk through the woods prepared the worshipper for meditation and prayer. Likewise, the walk from the car to the house should be a time of preparation for the social interaction or activity that is going to happen inside the home. If the transition from the street and automobile is a comfortable and pleasant experience for the pedestrian, then guests will feel more comfortable and pleasant once inside the home. On the other hand, if the transition from street to house is not pleasant, the guest may subconsciously have an unfavorable attitude about the host and surroundings.

Good planting design thus considers the front yard, not just foundation planting, and relies heavily on the functional spectrum of plants. The landscape design process is used to create the kind of entry place or front yard we want and will result in the use of plants, pavements, and structures. Pattern, textures, scale and form of these elements (plants, pavements, and structures) must be considered in the development of the design. We can create that certain feeling of privacy, personality, or sense of place we want our yard to express. However, certain environmental and space design problems must be solved by considering the functional spectrum of plants and applying the five design principles: simplicity, balance, scale, sequence, and focalization. Examples of apply-

Continues on page 78

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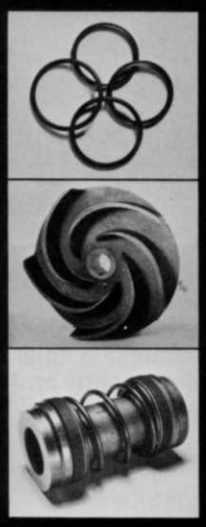

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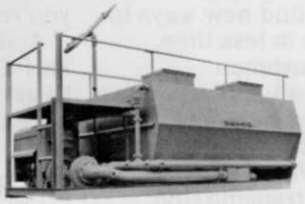

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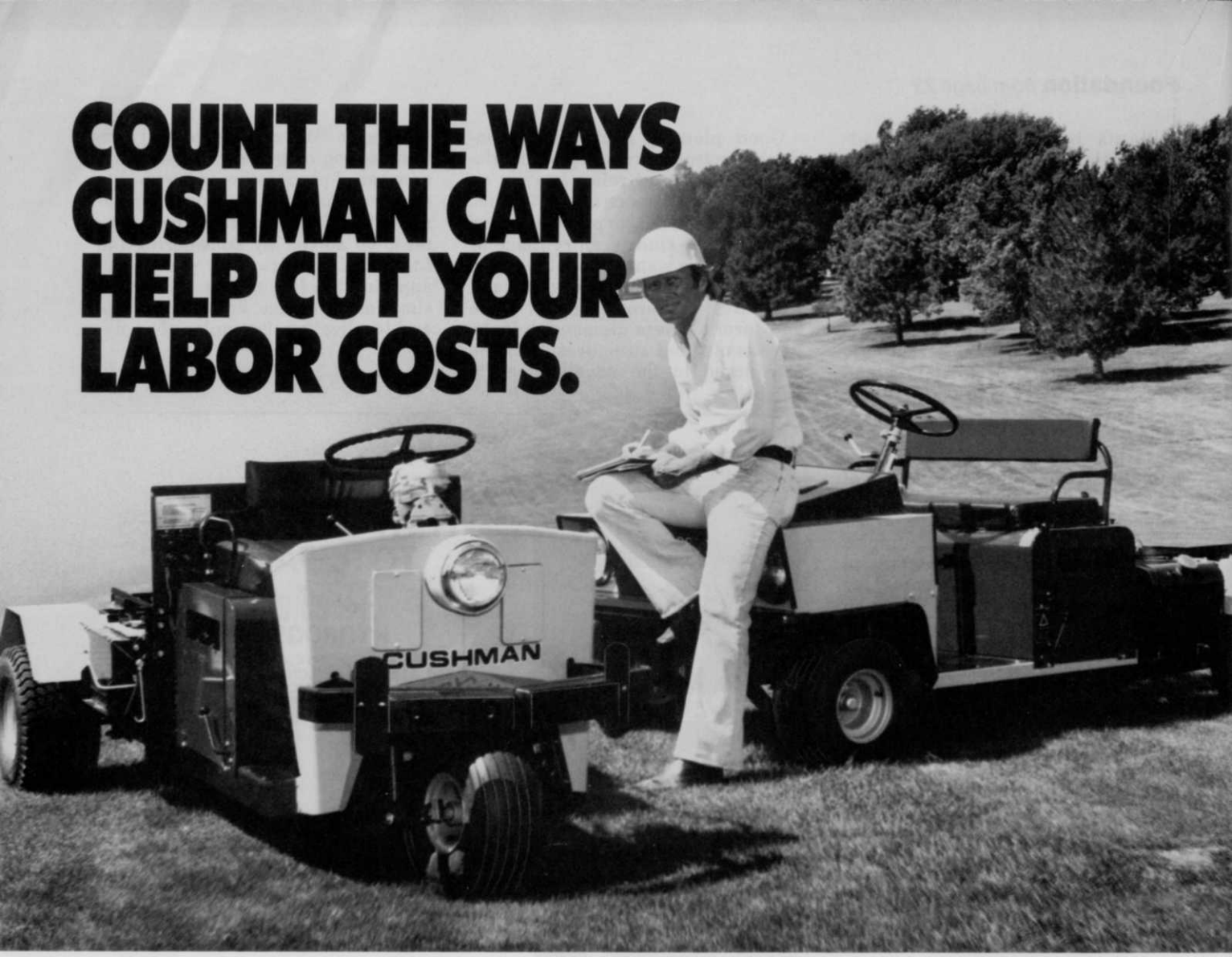

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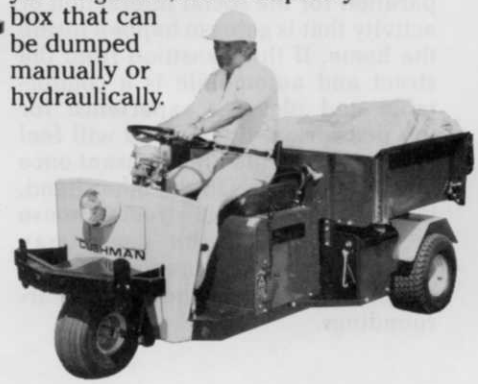

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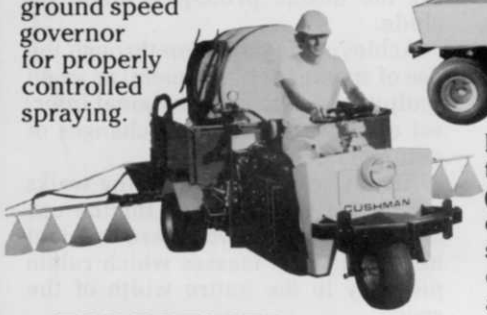

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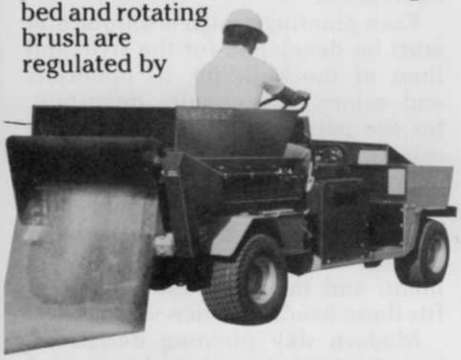

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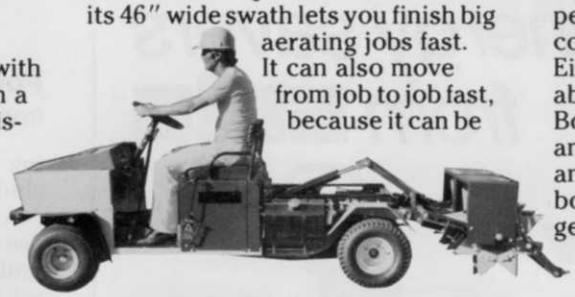

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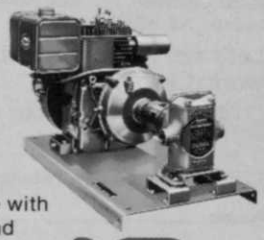

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Foundation

from page 75

ing the design principles might include:

Achieving focalization through the use of specimen plant, metal or wood sculpture, a light, the seasonal interest of flowers or foliage changes of autumn.

Achieving scale by creating walks which are wide enough for the use and space, fences which are the right height or plant masses which relate properly to the entire width of the space.

Achieving balance by considering the relationship of a large oak to another oak or to two or three small trees so that volumes are roughly equivalent.

Each planting design is unique and must be developed for the style and lines of the building, its materials and colors, and equally important, for the people who live there. The selection of plants should be based on whether or not the plant fits the design, not upon the individual characteristics of the plant. It is more important to know what is needed in a plant, and then find the plant that fits those needs, not vice-versa.

Modern day planting design attempts to integrate plants and architecture with the surrounding environment by allowing those things which need dominance to become focal and those things that are subordinate to fit into the background where they are appropriate. Even though the architecture has an important place in the development of the landscape design, it may be necessary to forego architectural dominance in order to create a solution that will make the program work. A building with excellent architectural features actually needs very few plants to accentuate its characteristics. However, to accomplish the design needs of the total property, a great many plants and structures might be necessary.

If on the other hand, one has a structure which is not architecturally pleasing, it may be necessary to use many plants to draw attention away from the architecture, by making the landscape dominant. However, if the program requires a very simple solution, it may be necessary to live with a highly visual dominant architectural element because of the nature of the needs and how one wants to develop the site. **WTT**

Singlehanded, you can whip fuel and labor costs with EXCEL HUSTLER *pure motion* at your fingertips.

To groundskeeping pros, EXCEL HUSTLER means Mower—and More—every season.

Two hydrostatic pumps transmit direct to drive wheels instantly in response to fingertip touch on twin hand levers. Dual pumps work only half as hard, last many seasons longer for added value and less downtime. But there's More: *Instant pure motion* moves the big mowers easily around trees, park benches, markers, and other mowing headaches. EXCEL HUSTLER owners mow More acres per hour, More grass per gallon, More years per mower!

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Control 15 major turf pests with versatile SEVIN® carbaryl insecticide.

They nip, munch, burrow and bite. As sure as grass is green, turf pests will try to make life miserable.

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STOP! ALL PESTICIDES CAN BE HARMFUL TO HEALTH AND THE ENVIRONMENT IF MISUSED. READ THE LABEL CAREFULLY AND USE ONLY AS DIRECTED.

And protect the turf you manage from as many as 15 different problem pests.

Both the most common ones and the worst: ants, bluegrass billbugs, chiggers, chinch bugs, cutworms, earwigs, European chafer, fall armyworm, fleas, green June beetle, leafhoppers, millipedes, mosquitoes, sod webworms (lawn moths) and ticks.

Broad registration only starts the list of SEVIN benefits.

It's also compatible with many other commonly used insecticides, miticides, fungicides and foliar nutrients. And residents can resume using the grounds or yard as soon as the spray dries. There's a choice of

four formulations—sprayable, wettable powder, flowables and SEVIMOL® 4, a liquid blend of SEVIN and molasses. Granules, dusts and baits are also available for certain specialized uses. Plus, SEVIN isn't harsh on the environment. It is biodegradable; and when compared with other insecticides, it ranks low in toxicity to people, animals, birds and fish.

So it's probably no surprise to hear that SEVIN carbaryl is one of the largest selling insecticides in the United States today.

For more information about SEVIN, contact your pesticide supplier or Union Carbide at the address below.

Make SEVIN carbaryl insecticide your answer to pest control too.

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CARBARYL INSECTICIDE
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Ditch Witch meets you halfway.

Looking for a trencher that's a bit more than a handlebar machine, but not quite as much as our 2200 riding unit? Now you can stop searching...the Ditch Witch 1810 meets you halfway.

This little 18-HP-class trencher has a unique design which locks all four wheels into equal drive at the push of a pedal. Ground drive is hydrostatic...same as our big R100 model. A pedal-engaged master clutch permits quick cold-engine starts and will disengage all functions.

The 1810's all-in-one, single gear box design houses the differential, hydraulic pump drive and transmission. It's also the hydraulic reservoir...a one-location time saver when it comes to routine hydraulic checks and regular maintenance.

Pre-set and self-adjusting belt tension, speed feathering control, hefty 20,000-pound-test digging chain...all these features and more. And in a cost versus payback challenge, the 1810 offers the labor and time-saving returns of many larger, higher-priced machines.

Contact your Ditch Witch dealer for a free demonstration. Call Toll Free (800) 654-6481 or write for more details.

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Check one or both:

☐ Please send me information on the 1810.

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VEGETATION MANAGEMENT

By Roger Funk, Ph.D., Davey Tree Expert Co., Kent, Ohio

Q: *What can you tell me about the interface that develops when a muck sod is laid on clay? I have been told that this can cause maintenance problems.*

A: Horizontal interfaces form when one soil type overlays another distinctly different soil type. This commonly occurs when peat grown sod is laid on clay soils without providing a transition soil between.

Water and nutrients do not penetrate uniformly into the bottom layer which inhibits root penetration and development. Proper gaseous exchange of oxygen and carbon dioxide between the bottom layer and the atmosphere also is impaired and surface run-off is increased. If the top 6 to 8 inches of the clay soil is amended by increasing the organic matter content and improving the structure, a transition from the organic muck soil to the mineral clay soil is provided.

Existing interfaces can be alleviated by periodic aerification which provides more uniform penetration and distribution.

Q: *Can you recommend a granular form herbicide for postemergent use in maintenance of common ornamentals and trees?*

A: All of the postemergent, granular herbicides of which we are aware are not selective, that is they would injure or kill both the weeds and the ornamentals.

Q: *Has any search been done on wood chips to derive any type of alcohol as a source of fuel?*

A: The idea of processing alcohol from wood is not new. Wood was distilled in the provinces of France to provide alcohol for burning in Paris in the mid 1800's and alcohol from wood chips was used during World Wars I and II in Germany and France.

An article in the December, 1973, issue of *Science* magazine by T.B. Reed and R.M. Lerner entitled "Methanol: A Versatile Fuel for Immediate Use" discussed the production of methanol from wood, coal, and organic wastes. More recently, scientists at the University of California Lawrence Berkeley Laboratory reported plans to have a full size demonstration plant by 1981 that could refine tons of wood chips into fuel oil.

Q: *I don't know how much of a problem velvetgrass is in other parts of the country but in our area (Delaware) it is a major pest. Is there any selective or cultural control?*

A: Velvetgrass *(Holcus lanatus)* is a bunch type perennial grass which frequents many northern lawns. In a survey conducted by the Lawn Seed Div. of the American Seed Trade Association, velvetgrass ranked as the 15th most troublesome weed to control in turf.

No herbicides are currently available which offer the selective control of velvetgrass when it appears among desirable turfgrasses. Since velvetgrass is well adapted to rich, moist soils and tolerates normal mowing heights, cultural controls are generally not recommended.

Hand digging of small clumps provides control since velvetgrass is desseminated primarily by seed. Use of nonselective herbicides, such as Roundup, amitrole, and dalapon, followed by reestablishment with desirable turfgrasses is suggested where a large population of velvetgrass exists.

Q: *What is the primary reason for difficulty in maintaining good turf on high school athletic fields?*

A: Many factors will affect the performance of turfgrasses on athletic fields, including kinds of grasses used, design and construction, drainage, seedbed preparation, and the maintenance program. Aeration is particularly important since constant trampling often causes the development of a compact, impermeable surface layer of soil.

Penn State has an excellent brochure entitled "Athletic fields—specification outline, construction and maintenance." You should be able to obtain a copy directing your request to Dr. John Harper, Extension Agronomist, Cooperative Extension Service, 106 Agricultural Administration Building, University Park, PA 16802. Contact your local cooperative extension office for specific recommendation concerning turfgrass selection and culture for your area.

Q: *What are the pros and cons for late fall fertilization? When is the best time and what is the best fertilizer to use, i.e., natural organic (Milorganite) or synthetics (chemical or urea formaldehyde, etc.)? I live in the Northeast.*

A: The concept of late fall (dormant) fertilization originated in the transition zone to encourage more vigorous root growth and maintain better winter color of cool-season turfgrasses. Recent research has shown promising results in the Northeast.

Among the positive effects of dormant applications of nitrogen are increased root growth and development, stimulation of basal shoot or tiller development, less chance of burn and no increase in winter injury. Disadvantages include some increased leaching, the possibility of more early spring growth than is desirable and increased potential for leaf spot disease.

Depending upon the local climate, dormant applications in the Northeast can be made from late October through February. Research conducted at Rutgers University indicates that the best results can be obtained from 1 to 2 lbs. nitrogen per 1,000 sq. ft. applied in December. In the same tests, urea outperformed three slow-release nitrogen sources.

There just isn't another sod cutter built like Ryan's.

This is the Ryan® Jr. Sod Cutter. The latest in a line that started 24 years ago. Naturally, we've made quite a few improvements since then, but today's Jr. Sod Cutter delivers the same, everyday dependability and reliable performance that made our first model so popular. Here's why.

(1) It has simple, one-man operation; (2) Hand lever controls set the cutting depth up to 2½"; (3) A rugged 7-hp engine delivers plenty of power; (4) You can choose 12" or 18" width models; (5) Its heavy-duty gear box is built to last year after year; (6) Self-propelled action lets you cut up to 135 feet of sod per minute.

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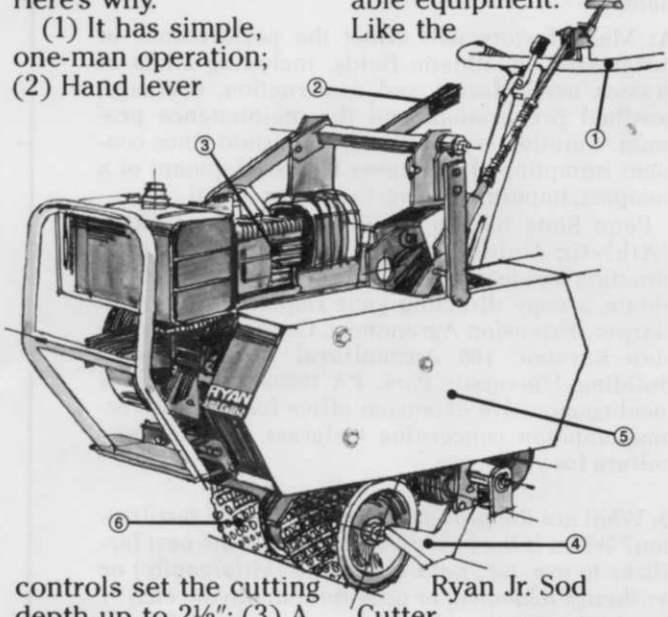
Ask your Ryan dealer for a demonstration, and see for yourself how we build a sod cutter. 80-CUR-5



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SOD PRODUCER NEWS

'Plush' Kentucky bluegrass receives registration

Registration has recently been accepted for 'Plush' Kentucky bluegrass *(Poa pratensis L.)*

'Plush' Kentucky bluegrass, developed and released by FFR Cooperataive, is a moderately low growing, leafy, turf-type bluegrass with medium texture, good vigor, persistence, density and aggressiveness, and medium green color. It has demonstrated good resistance to stripe smut and moderately good resistance to leaf spot and stem rust. It is well suited for quality lawns, parks, and sports turf in regions where Kentucky bluegrass is well adapted.

Natural turf returns to America's athletic fields

The discovery of many disadvantages to playing on plastic turf makes the future look brighter for natural turf on athletic fields.

Owners of athletic complexes with plastic turf have become aware of the intense heat generated on a hot day from plastic turf. It also seems to have increased the injury and infection rates in football games and is almost impossible to play on when a cold drizzle turns to ice.

The Orange Bowl at Miami ripped out its plastic and sodded with a bermuda grass. The University of Minnesota replaced its plastic with a bluegrass blend.

Warren's Turf Nursery of Palos Hills, IL, has seen Candlestick Park in San Francisco replace its plastic with the company's BenSun (A-34) bluegrass. And recently the White Sox in Chicago replaced their plastic with another Warren grass, A-20 bluegrass. Many other major athletic fields in the norther states use Warren grasses.

Tandem disk still best tool for blending herbicides

In an updated report on weed control, researchers using fluorescent dye found that the tandem disk did an excellent job of incorporating herbicide down to 3 inches following a plow and tandem disk.

Dr. Nathan L. Hartwig, research agronomist at the Pennsylvania State University, and associates also found that blending into the soil was excellent down to 3½ to 4 inches after a chisel plow, and equally effective down to 4½ to 5 inches after plowing.

Control of annual grass and yellow nutsedge was good with the tandem disk. Dr. Hartwig said this tool seems to be the best where both shallow-germinating annual grasses and deeper-germinating yellow nutsedge are problems.

News *from page 14*

GROUNDS

Applications available for manager's program

The Professional Grounds Management Society has announced that applications for its Grounds Manager's Certification Program are now available.

Contact Allan Shulder, Executive Director, PGMS, 19 Hawthorne Ave., Pikesville, MD 21208, 301/653-2742.

PLANTS

Plants may provide own water and heat

Experiments by British researchers with a new energy-conserving commercial glasshouse are attempting to show that much, if not all, of the heat and water requirements of plants grown in commercial glasshouses could be provided by the plants themselves.

Keith Morgan, lecturer in Agricultural Engineering at Reading University, has recaptured both the energy and water used in transpiration by dehumidifying the air in the glasshouse. Further research developed the possibility of feeding plants with salt water and recovering it as fresh water during transpiration. Up to 4 liters a day per square meter of space can be recovered from many green plants grown in a glasshouse.

The glasshouse contains a glazing with a specially formulated material, ultra violet inhibited melinex, developed by Imperial Chemical Industries, Plant Protection Div., Fernhurst, England.

NEW FACILITY

Conwed completes mulch fiber plant

Conwed Corp. of St. Paul, MN, has finished building a wood fiber manufacturing facility in Conover, NC, to produce mulch for hydraulic mulching.

The product, sold nationally under the Hydro Mulch trademark, aids in rapid turf establishment and erosion control in strip mines, on roadways, and at commercial and residential buiding sites.

The plant, which contains a 5,000-square-foot manufacturing area, cost more than $2 million to build.

Save 50% on labor costs.

Jobe's Tree & Shrub Spikes provide proven, efficient feeding. Eliminate any special tools. Furnish extra income for lawn care customers.

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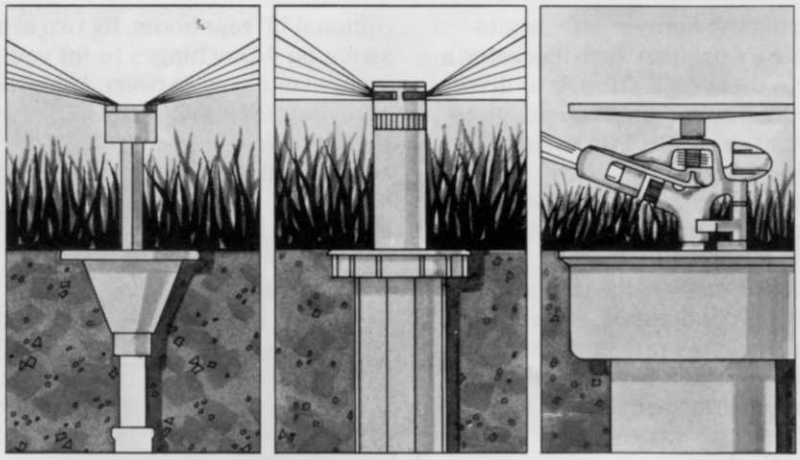

From residential to light commercial turf installations, Champion has a pop-up to do the job! When you compare the cost, precision construction and performance, you'll buy Champion. The 18HP (2" pop-up), the P180 (2½" pop-up) and the 6178 Impulse pop-up are just three of over one-hundred fifty sprinklers, valves, controllers and accessories featured in the new Champion, full-color catalog. Ask for your free copy.

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News *from page 85*

COMPANY

International Harvester names three managers

International Harvester's Agricultural Equipment Group has appointed three people to its newly-restructured Outdoor Power organization, North American Operations.

The company appointed Thomas H. Solomon manager, Outdoor Power manufacturing operations; Thomas Jaros, manager, product and financial planning; and Ronald F. Zitko, manager, engineering.

IH's lawn and garden tractor line consists of five Cub Cadet models ranging from 11 to 19.9 horsepower and three Cadet models from 8 to 11 horsepower.

Stripling to head Ortho Chemicals Div.

Earl L. Stripling, Jr., has been named vice president of Chevron Chemical Co., a subsidiary of Standard Oil Co., and general manager of its Ortho Agricultural Chemicals Div.

Stripling joined Ortho as a sales representative in 1949 and most recently was marketing manager, Agricultural Chemicals. He also served as president, Chevron Chemical International, Inc. and Chevron Chemical Pan America Co.

Jacobsen appoints new general manager

Philip A. Taylor has become general manager, service, for the Jacobsen Div. of Textron Inc.

In this capacity, he is responsible for administration of domestic and international service for consumer and turf products, including warranties, training, and manuals and other service publications. He was previously manager, turf services for Jacobsen.

Davis changes name to Case

The Davis Div. of J I Case Co. has changed its name to J I Case Light Equipment Div.

The division, which has manufactured trenchers, material handling equipment, and cable-laying equipment in Wichita and marketed them in North America under the Davis name, will now sell its product lines under the Case name.

Arnold Palmer to promote Lofts

Lofts Pedigreed Seed has chosen golf pro Arnold Palmer to promote its line of seed and turf care products in 1980 advertising.

Palmer was first considered as a possible promoter for the Lofts line when he began using Yorktown Ryegrass and Baron Kentucky Bluegrass on his courses in Orlando, FL, and LaTrobe, PA.

NOT JUST A SPRAYER. A BETTER WAY TO SPRAY.

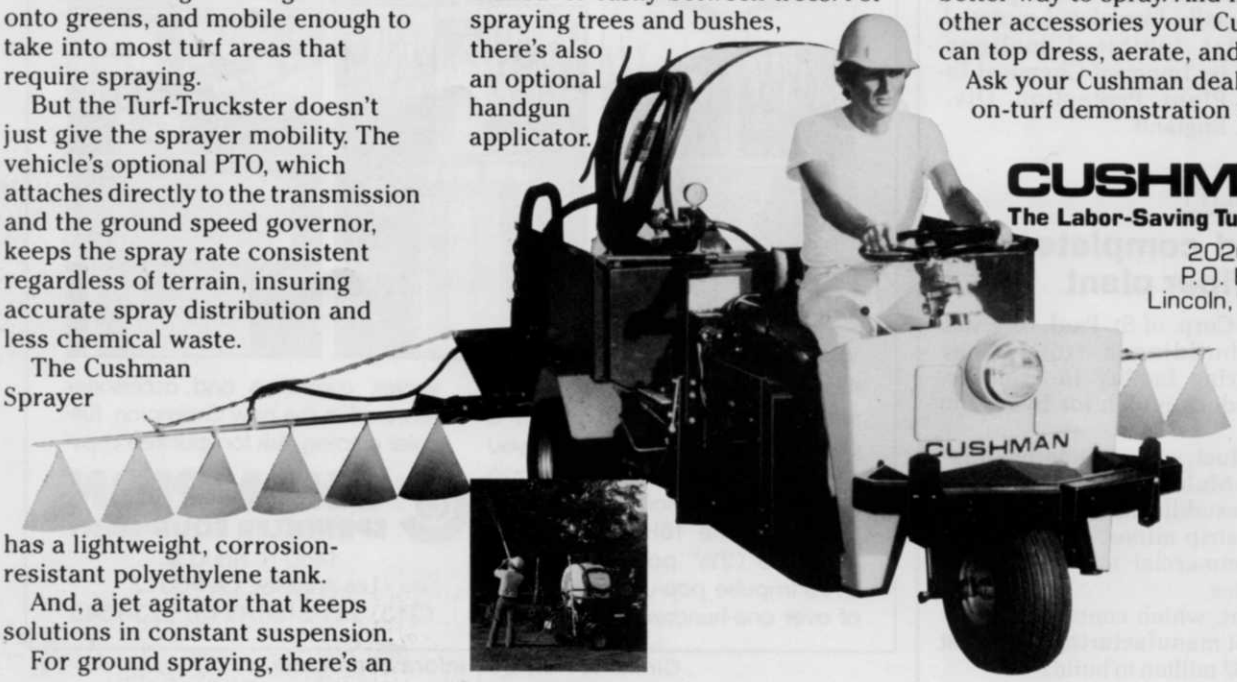
Cushman's Sprayer attaches to the 18-hp Cushman Turf-Truckster, a vehicle that's light enough to drive onto greens, and mobile enough to take into most turf areas that require spraying.

But the Turf-Truckster doesn't just give the sprayer mobility. The vehicle's optional PTO, which attaches directly to the transmission and the ground speed governor, keeps the spray rate consistent regardless of terrain, insuring accurate spray distribution and less chemical waste.

The Cushman Sprayer has a lightweight, corrosion-resistant polyethylene tank.

And, a jet agitator that keeps solutions in constant suspension.

For ground spraying, there's an optional 15′ rear boom. Its two arms swing on 4-way hinges to let you maneuver easily between trees. For spraying trees and bushes, there's also an optional handgun applicator.



See for yourself how the Cushman Sprayer attachment gives you a better way to spray. And how with other accessories your Cushman can top dress, aerate, and dump.

Ask your Cushman dealer for an on-turf demonstration today.

80-Cut-3

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Elanco's Surflan® gives you months of weed control for only pennies per 1,000 sq. ft.

Where ornamentals are grown, and annual grasses and broadleaf weeds are a problem Surflan delivers outstanding weed control.

Does your herbicide measure up to Surflan?

	Length of Control	Economical	User Safety Category	Ease of Application
SURFLAN®	6-8 mos.	$23-$45 per acre	Category 3 Caution	Surface applied Spray
Other Herbicides	Does yours last as long?	Up to $90* per acre?	Caution 3 Warning 2 or Danger 1	Does yours need mechanical incorporation, or immediate rainfall or irrigation?

*Based on manufacturers suggested retail prices.

Maybe you should compare your herbicide with Surflan in some other ways too.

Whenever annual grasses and most broadleaf weeds are a problem in ornamentals depend on Elanco's new Surflan for months of weed control at a reasonable price.

Another of Elanco's dependable weed control crew.

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A Division of Eli Lilly and Co.
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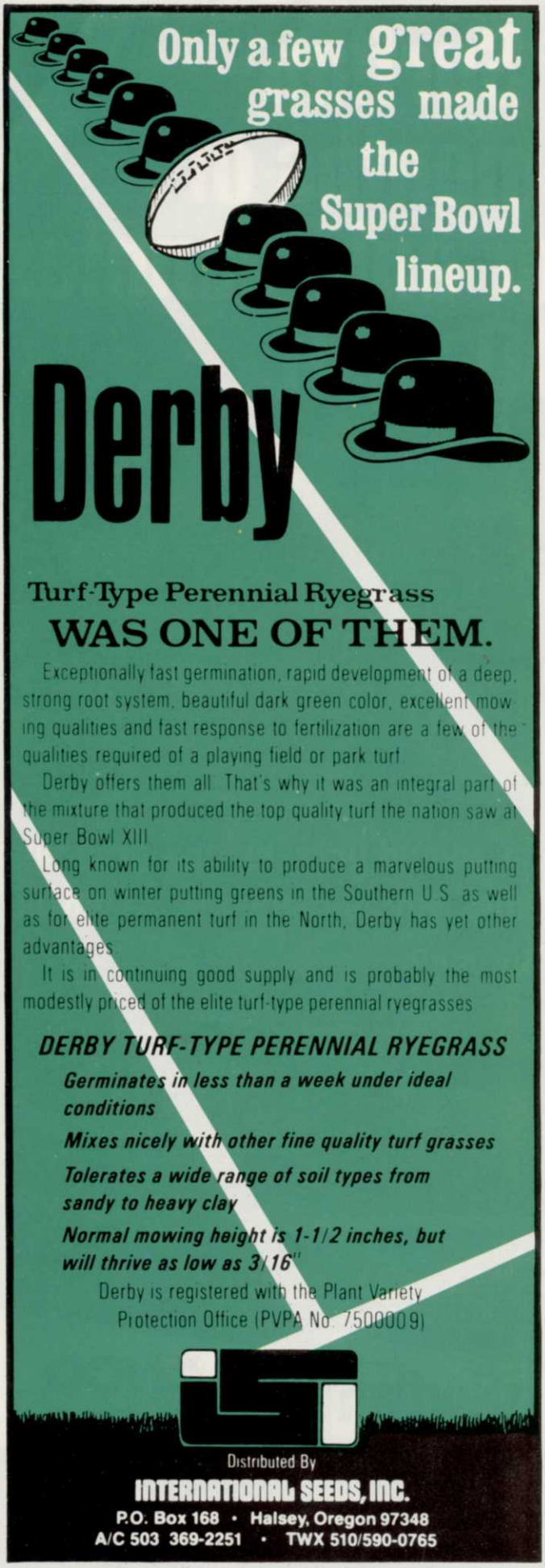
Indianapolis, Indiana 46206 U.S.A.



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News *from page 86*

GOLF

Hale named GCSAA communications director

Dick Hale, former editor of THE GOLF SUPERINTENDENT, official publication of the Golf Course Superintendents Association of America, has returned to GCSAA as the director of communications.

Hale has been editor of PGA MAGAZINE and business manager of all publications of the Professional Golfers Association since the fall of 1976. He served as editor of THE GOLF SUPERINTENDENT, forerunner of GOLF COURSE MANAGEMENT, from 1974 to 1976.

As director of communications, Hale will serve as editor of GOLF COURSE MANAGEMENT and coordinate other activities of the GCSAA communications department. He replaces John Schilling, who is now GCSAA director of marketing and sales.

In another announcement, the GCSAA gave three golf course superintendents Citation of Performance awards at the United States Golf Association Green Section educational conference held on Jan. 25 at the Ritz-Carlton Hotel in Chicago.

The three — William L. Burdick, Canterbury Golf Club, Beechwood, OH; Frank Nichols, Brooklawn Country Club, Fairfield, CT; and Wilbert Waters, the Inverness Club, Sylvania, OH — were honored for their work in preparing their courses for major golf tournaments in 1979. Burdick's club hosted the U.S. Amateur Championship Aug. 28-Sept. 2; Nichols prepared the Brooklawn course for the U.S. Women's Open July 12-15; and Waters' club hosted the U.S. Open June 14-17.

PESTICIDES

Dipel insecticide labeled for 200 crops

The Environmental Protection Agency has granted the broadest pesticide registration in its history to Dipel insecticide for caterpillar control on more than 200 agricultural and horticultural crops.

Dipel is a biological insecticide containing the naturally occurring bacterium, *Bacillus thuringiensis*, which selectively kills lepidopterous (caterpillar) pests without harming bees or disrupting activities of beneficial insects or wildlife.

"The registration is a step forward in pesticide regulation," says Harry Mercado, product manager at Abbott Laboratories, manufacturer of Dipel. "Previously, pesticide registrations for specialty and minor crop uses were limited due to the expense inherent in seeking registration, and the limited sales potential of these markets. The new Dipel registration covers broad crop groupings rather than individual crops, and thus expands the worm control options for thousands of growers."

Some of the crop groupings covered in the label include nuts, ornamentals, shade trees, cane and bush berries, various kinds of fruit trees, and many vegetables.

TREES

Cities develop ways to manage Dutch elm

Nineteen communities in Wisconsin are participating in a program to control Dutch elm disease, proving what information and better funding can do to manage the problem.

University of Wisconsin-Extension education coordinator for Dutch elm disease Charles Kostichka says the program is changing attitudes about controlling the disease. "We're not offering any false hopes; we will continue to lose elms in our cities he says. "However, by stepping up control efforts, we can slow down the loss."

Proper management reduces elm removal cost and property value loss by 75 percent over a 15-year period. Without management, a city can lose all its elms in 10 to 15 years. Intensive control can keep trees alive for 50 years and longer. This allows time to replace the elms gradually and spreads out replanting costs.

The state control program is a U.S. Department of Agriculture Forest Service funded project. Most of the project's $579,000 budget for 1979 went directly to participating cities, which used most of the funds to improve disease detection and to remove trees. "The key to Dutch elm disease control is complete sanitation through removal," says Kostichka.

Demonstration cities are evaluating a systemic control fungicide sold under the trade names Arbortect S and Arbortect 20S. Also under study are various methods of injecting the fungicide into trees and several types of equipment. Kostichka says that dead and diseased elms must be removed for the fungicide program to be of any value.

Continues on page 91

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Smoother ride.
More stability.

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Twice as much as a utility truck and sprayer.

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Hahn Spray-Pro

Precision application. Fast efficient spraying.
Centrifical pump. 100 p.s.i. max. 55 g.p.m.
High pressure piston pump and hand gun optional.
16 h.p. cast iron engine. 3-speed transmission
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- **apply with brush or spray; produces a black, tough, elastic, quick-drying coating.**
- **excludes moisture; stops rot; prevents evaporation of sap**
- **may be used in any season**

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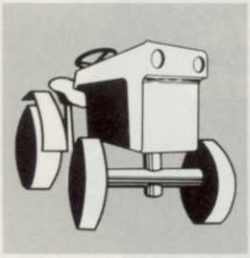

Whether taking care of property is your business, your pleasure, or simply your responsibility, you need the proper equipment to do a proper job.

Satoh tractors are engineered for the optimum blend of power and speed for efficient and economical performance in a complete range of applications. And throughout Satoh's full line of 14 diesel and gas-powered 2 and 4-wheel drive tractors, sized from 15 to 38hp, the features most often demanded by professionals are standard.

For example. Dual-range multi-speed selective sliding gear transmission with differential lock. Power take off with multi-step speed control and integral safety shield around the PTO shaft. Live hydraulic implement control and rugged Category I 3-point linkage. Environmentally-sealed brakes with independent pedals and hinged interlocking plate. Heavy-duty electrical starting system for all-weather dependability. Full instrumentation for instantaneous monitoring of all engine functions. And more.

Your Satoh dealer can show you the complete range of standard features and available options as they pertain to specific models. Such as the 15hp Beaver and the 3-cylinder 16.5hp Beaver III, two of Satoh's compact water-cooled diesels with performance capabilities seldom found in their class. Or the 25hp water-cooled diesel Bull. With 12-speed dual-range transmission, 4-step PTO and simple interchangeability between estate, agricultural or wide turf tires, it's the most efficient and versatile mid-size utility tractor for grounds maintenance or construction applications on the market today.

If you're serious about what you do, forget the toys. And look at Satoh. The professional tractor people.

Satoh. Satisfaction!

Get it at your **SATOH** *tractor dealer. P.O. Box 5020, New York, N.Y. 10022*

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News *from page 89*

MATERIALS

Thermoplastics favored over metals in report

In Europe, engineering thermoplastics can be expected to continue to take market share away from metals, despite oil price increases that would seem to hurt hydrocarbon-based plastics, according to a report by Frost & Sullivan, Inc.

The report says, "Steel, aluminum, zinc, copper, and most other metals are more energy expensive on a cost per unit volume basis than are plastics." The 286-page report, entitled "European Market for Engineering Thermoplastics," says, "The competition between engineering thermoplastics and zinc and aluminum diecastings has been won in almost all applications by plastics."

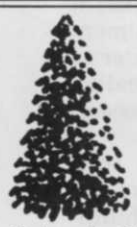
And it adds, "Pending legislation (to lessen automobile weight and improve safety) will also stimulate the use of more thermoplastics in automobiles.

Acid from fertilizers countered by lime

Almost everything man adds to and does to the soil, except applying lime, tends to make the soil acid. Any action that generates positive ions in the soil—tilling, growth of plants, and fertilizers—creates acidity.

The greatest cause of soil acidity is the use of ammonium-type fertilizers. Such fertilizers include animal manures, plant residues, organic nitrogen fertilizers, anhydrous ammonia, urea, ammonium sulfate, and half of the nitrogen in ammonium nitrate. This comes from both biological and chemical activity.

According to the National Limestone Institute, it requires about 3 pounds of limestone to neutralize the acidity formed by one pound of nitrogen. Because of the time required for lime to react and the difficulty of even spreading, the association suggests applying 5 pounds of limestone for each pound of ammonium nitrogen applied.



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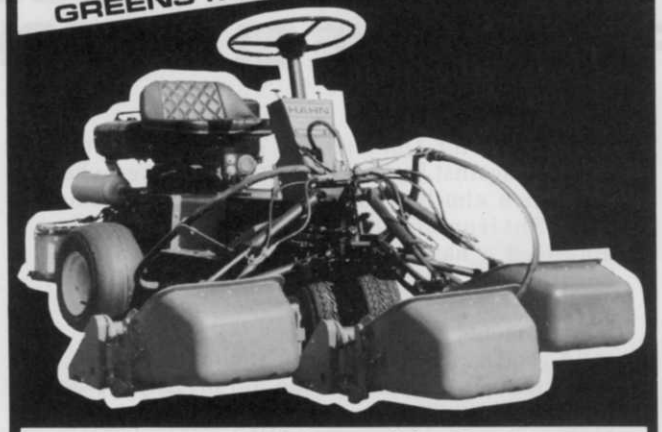

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NEW DURSBAN LABELS CLEAR WAY FOR NATIVE ELM BARK BEETLE CONTROL

New labels for Dursban are providing a backup defense against Dutch elm disease in states where the native elm bark beetle is the primary vector. The Environmental Protection Agency has approved a national label for Dursban 2E and a Local Needs Registration for Dursban 4E in Minnesota where research on native elm bark beetle management has been centered.

"A good sanitation program, including debarking of all elm firelogs, is still the top priority," points out Bill Phillipsen, extension entomologist at the University of Minnesota. "We're reaching the point, though, where cost and logistics in epidemic areas are making it very difficult to keep up with diseased tree removal and downed log disposal.

"In the Minneapolis-St. Paul-Bloomington area alone, estimates on diseased elms in 1979 range up around 77,000 trees. With present costs for labor and equipment, the price tag for removal and disposal will run in the neighborhood of $30 million. We find we're in the same 'catch-up' situation with Dutch elm disease that other communities faced in the lower Midwest and East about 10 to 20 years ago."

The research has been conducted in several communities over the past several months by Phillipsen and associates Mark Ascerno and Val Landwehr, under funding from the Minnesota Dept. of Agriculture Shade Tree Program. The product earlier was registered and has been used successfully in native elm bark beetle control programs in Canada.

DED in Minnesota

Dutch elm disease was first reported in Minnesota in 1961. As is typical of many infestations around the country, the disease had relatively little impact on elm populations for 12-14 years. Then DED multiplied rapidly.

"In the last five years, we've lost more than 20 times the number of elms killed in the first 14 years. The rate will continue to escalate unless comprehensive management programs are implemented," explains Phillipsen.

"Costs for tree removal are essentially unavoidable. If communities do nothing to slow down the spread of Dutch elm disease, they will still have to remove dead and dying trees to keep them from falling across power lines, into houses, over traffic routes and so forth. We're looking at practical ways to disperse these removal costs over several years."

From a total elm population of about 5 million trees, the Twin Cities seven-county metropolitan area still has 4,500,000 that are disease-free, according to Phillipsen. If DED is allowed to progress at its normal logarithmic rate, virtually all elms in that area will be destroyed over the next 10 years.

With today's cost of tree removal averaging nearly $400 apiece, the expense would add up to a staggering $1.8 billion. This does not take into account the aesthetic impact on communities, depreciation in home values due to loss of the majestic shade trees, or damage losses attributed to falling limbs and trees.

Two insects serve as elm fungus disease carriers—the smaller European and the native elm bark beetle. Both reproduce during the summer months in downed elm logs or diseased trees, which points up the importance of sanitation programs to deprive both insects of egg-laying sites, as well as to reduce the natural reservoir of disease fungus.

In some parts of the country, European elm bark beetles are the prevalent species. In Minnesota, however, native beetles far outnumber the European.

"In the northern two-thirds of Minnesota, the native beetle is the main and, in many instances, the exclusive carrier of Dutch elm disease," says Phillipsen. "In the southern third, the native is an important carrier along with the European beetle."

Insect studies indicate that only two or three percent of the overwintering European beetles are likely to be carrying the disease fungus. "In our studies, about 30 percent of the overwintering European beetles carried the fungus. It only takes one beetle to infect a tree."

Both insects do most of their damage in the spring when they emerge from overwintering sites. Natives emerge first, starting around mid-April or early May, and fly into larger branches of healthy elms to feed. Trees are particularly vulnerable at this time, when new growth is being added and rapid transmission of the fungus can occur.

European beetles emerge about a month later and feed on smaller twigs and branches. Disease fungus introduced at this time usually spreads more slowly through the tree. If disease symptoms—leaf wilt and brown discoloration in twig cross-section—are detected early enough, it may be possible to save most of the tree by cutting out the infected branches.

A key to stopping native beetles was discovered in a "weak link" in its life cycle, which makes it much more susceptible to insecticide treatment than is the European. Native beetles overwinter as adults in the bark along the lower trunk of healthy elms. European beetles seek out downed trees and logs, overwintering in the larval form.

"By treating the bases of healthy elms with Dursban, we've destroyed over 97 percent of the native beetles overwintering there," notes Phillipsen. "In addition to its effectiveness, another important advantage is that it doesn't repel the insects. The beetles do not avoid treated elms even when there are untreated trees nearby."

Application guidelines

Two formulations of the chlorpyrifos-based insecticide are registered for use in Minnesota—Dursban 2E and Dursban 4E. Application rate is .5 percent active ingredient solution with

water, sprayed to wet (not run-off) the basal 2-2½ meters (6-8 feet) of standing healthy elm trees (one gallon of 2E in 45 gallons of water equals .5 percent; enough for approximately 90 trees).

The entomologists do not recommend that this management technique be left to individual homeowners, because effective control of beetle populations must be handled on a communitywide basis. At present, trained municipal employees and licensed pest control operators represent most of the qualified applicators. The Minnesota SLN 24c label must be in the possession of the user at time of application.

"The best time for application is late August to mid-September," adds Phillipsen. "This would be just before native beetles start their search for overwintering sites. Extra care should be devoted to the basal six inches of the tree, including root flare. Young elms (up to 8 inches in diameter) and thin-barked elms are especially vulnerable to the beetles."

Fall treatment is preferred because beetles can introduce the fungus directly into healthy trees as they make their overwintering tunnels. The "bottom up" disease symptoms are similar to those associated with root graft transfer of DED from infected to healthy elms. Spring treatments also can be effective by destroying beetles as they emerge to begin their feeding and reproductive cycle. The research team has monitored Dursban insecticide effectiveness for more than nine months, so a repeat treatment in the fall should not be needed where spring applications are made.

"Tree spray programs we've outlined will normally be conducted early enough in the spring and late enough in the fall that they won't conflict with most of the ongoing sanitation projects," explains Phillipsen. "From this standpoint, communities will be able to utilize their available manpower and equipment without a lot of additional expense."

"The cost of insecticide will run about 25 cents a tree, assuming an average 33-inch-diameter trunk. Most communities already have low-pressure sprayers and water tanks that are used in present weed and insect control programs, which can be used for these applications as well."

Continues on page 94

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Elm *from page 93*

Alternative methods

Essentially all U.S. elms are susceptible to Dutch elm disease. In northern states, approximately 95 percent are American (white) elms, with the remainder made up of red elm and rock elm species. A few foreign species, including the Chinese and Siberian elms, are fairly resistant to Dutch elm disease. Some have suggested importing these to replace native elms that have been lost to DED.

"We're not recommending this because they would serve as reservoir hosts for the disease, making it even more difficult to slow the destruction of our native elms," says Phillipsen. "They have other drawbacks, too. They're fast-growing, but brittle, so they tend to lose their branches. And they don't have the shape and structure of the American elm."

What about pheromone projects?

"The pheromone-trap method may show some promise in wild areas with only European beetle populations, but we haven't discovered a similar sex attractant that works with native beetles," replies Phillipsen. "We consider pheromone traps, at this point, to be a valuable monitoring tool for European beetle infestations."

As for a large-scale program based on pheromone use, there are disadvantages. By attracting a large number of beetles to a certain area, again a reservoir of fungus and beetles will probably build up. And there's the problem of isolating the treatment area. The best results obtained in recent tests indicate at least 3 to 13 percent of the beetles will still escape this method."

A great deal of research also has been focused on methods of combatting the DED fungus itself, instead of concentrating on the insect carriers. Are any of these being utilized on a significant basis?

"A variety of both chemical and biological agents have been tested as tree inoculants, usually under strictly controlled environmental conditions," says Phillipsen. "In a few instances, they've given good results. So far, however, there is nothing that has proved consistently effective in controlling the disease fungus in field applications.

"Translocation of any substance throughout the tree is extremely unpredictable, depending on environmental factors like moisture and temperature, plus size, age, photosynthetic activity and other plant physiological conditions. The interrelationships are very complex."

"Probably the greatest drawback, though, is cost. Most of these methods require specialized equipment and take more time. We feel our efforts should be directed primarily at aggressive sanitation programs to stop the disease carriers. And, since the native elm bark beetle essentially bypasses sanitation programs in its overwintering habits, we believe the insecticide spray method can prove to be a valuable augment to sanitation."

Dursban is a product of Dow Chemical Co., Midland, MI.

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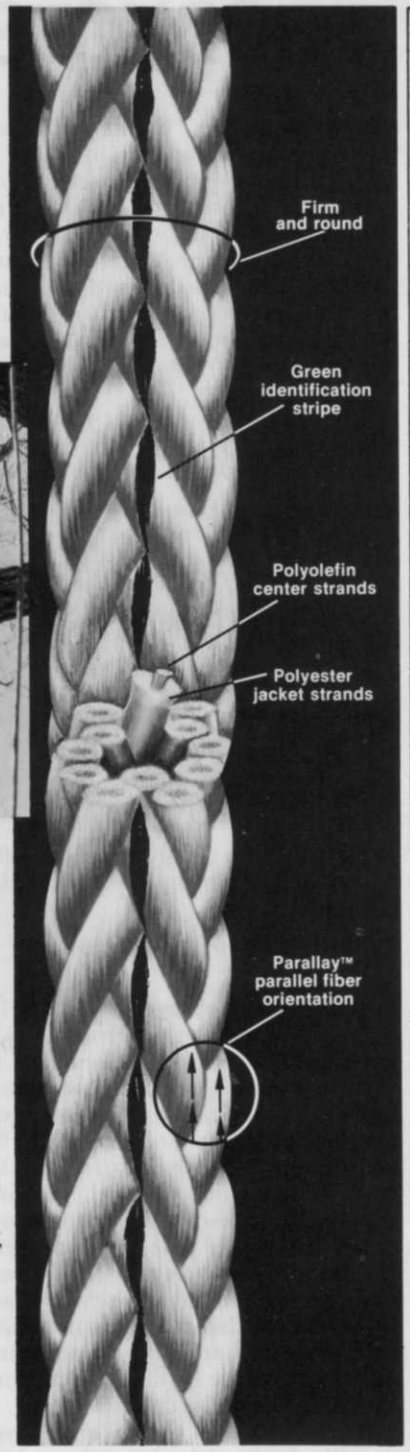

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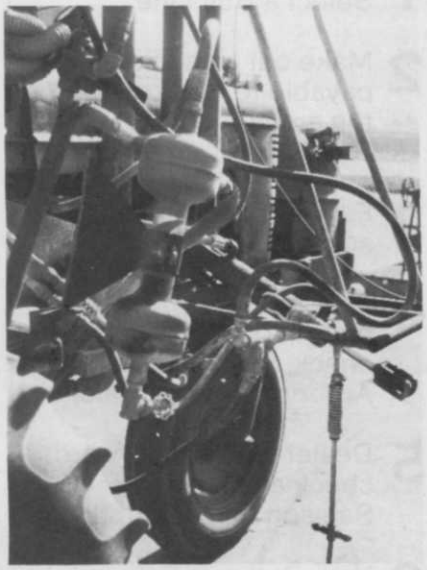

98 percent of all particles as small as 200 mesh from their source water for mixing with chemicals. Only maintenance required is an occasional purge of the solids collection chamber.

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Hahn, Inc. has introduced a self-propelled, all-purpose sprayer, the Spray-Pro. It has a 16-horsepower engine, 3-speed transmission and 160-gallon poly tank. Standard

sprayer has a centrifugal pump and 16-foot boom. High flotation tires assure little turf loading. Optional features include hand gun kit, 22-foot boom, and high pressure pump kit.

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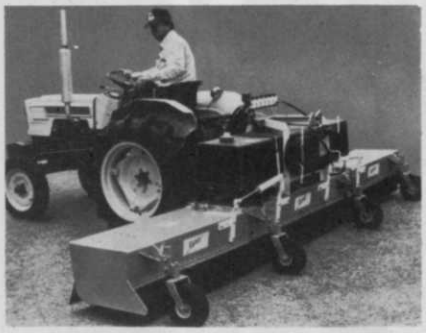
A protective hood houses the entire application system of the Kleco drip-proof sprayer made by Buffalo Turbine AG Sales of Texas. This control system works for insecticides, herbicides, fungicides, liquid fertilizers, soil sterilants, and lawn dyes. It helps eliminate chemical drift due to wind and upward movements; protect operator from contact with spray regardless of wind direction; and reduce both stream contamination and the cost of spraying by requiring only the minimum application recommended by chemical manufacturers.

Reliable PTO-driven pump and other parts provide little maintenance problems. It will convert from



three-point to dragtype hitch with gas-inversion power for practically all towing systems.

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A mobile boom sprayer, the Mark III Spray-Hawk, eliminates all guesswork in applying chemicals to turf. It provides easy, fast spraying; accurate, uniform applications; and positive protection of fine turf. By coordinating the pressure of the sprayer with his natural walking speed, operator can apply the exact amount of turf chemical recommended. You can spray at the exact rates recommended by the manufacturer in a precise, uniform spray pattern to avoid harmful over-spraying and obtain more efficient and economical use of spray chemicals.

Spray-Hawk is lightweight, yet sturdily built with a stainless steel boom for long life. It has a positive on-off spray with easy-to-use pistol grip control. No-drip nozzles automatically close when pressure falls below 3 psi.

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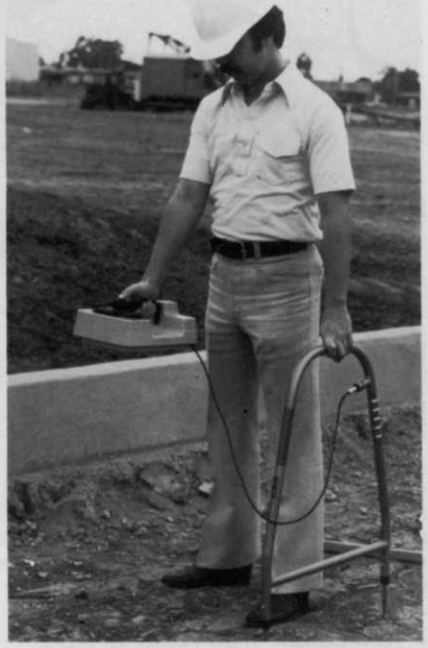

The device locates cables and gauges their depth. Then any damaged section can be found by following the cable and watching the meter.

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The WS-480 Grounds Wheelie manufactured by Wheel Spray Corp. is a liquid chemical spreader with a ground-driven pumping system. It is motorless and does not require gasoline, batteries, cords, or water hoses. It applies liquid fertilizers, fungicides, herbicides, insecticides, and growth regulators. The twin wheel pumps spray a fan of solution 6 feet wide at 1,000 square feet per gallon. Coverage is relatively unchanged by the speed at which the sprayer is pushed; the faster it is pushed, the faster it pumps.

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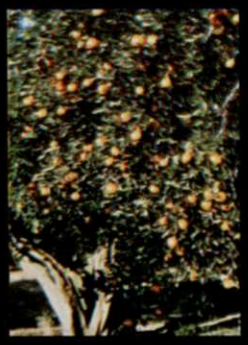

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Products

from page 96

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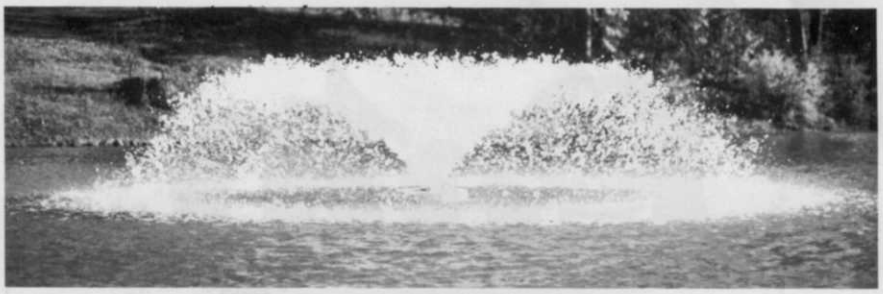

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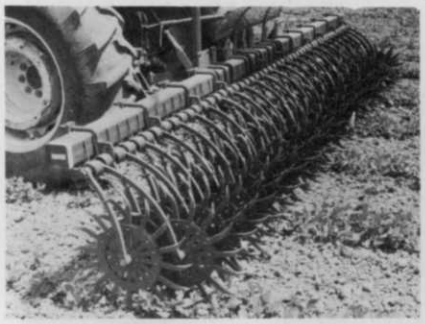
Products

from page 99

cushioned arm that rises and falls following ground contours and over heavy rocks or other obstructions. The hoe cultivates 30- or 40-inch



rows without adjustment. Its 3-point hitch matches category II, III, and most quick couplers. A safety shield offers operator protection. Yetter Manufacturing Co. makes it.

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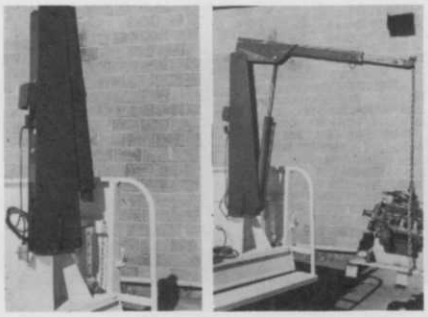
The EH-4 truck crane, an electric/hydraulic model, for use on one ton and heavier trucks, holds 4,000 pounds yet weighs only 350 pounds. A manual extension reaches an additional 15 inches from its max-



imum vertical reach of over 11 feet. The crane stands 64 inches high above the truck bed in the stowed position. The truck's electrical system powers it and a double acting hydraulic cylinder provides both power up and power down to the boom. GS Industries, Inc. makes the crane.

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Variable length auger extensions from the McMillen Div. of States Engineering Corp. are available to adapt McMillen 6 through 36-inch-diameter augers to most other hydraulic digging heads. They come in two sizes, 24 and 48 inches, both designed to be stored inside the auger shaft, adding 6 inches to the digging depth of the auger. The 24-

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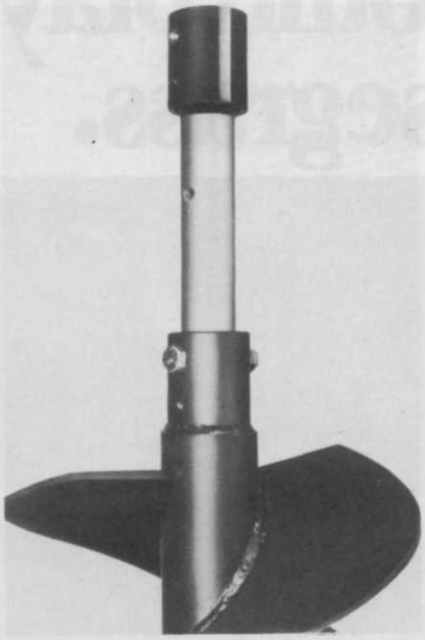
inch extension adjusts in increments of 6 inches. The 48-inch extension's



first increment is at 6 inches with three additional adjustments of 12 inches each. Fully extended, it provides a digging depth of 8 feet with a 4-foot auger.

Circle 712 on free information card

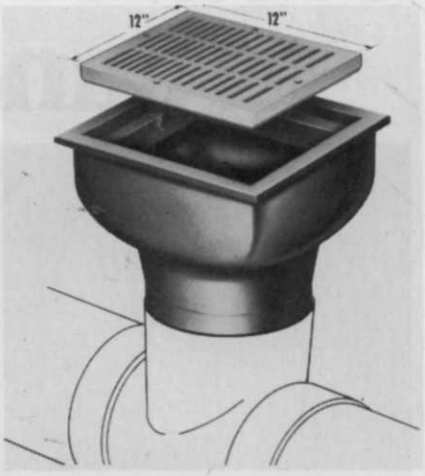
FMC Corp. sprayers have been designed by its Agricultural Machinery Div. for a variety of uses.

Model C005 has a 15-gal., high-density, cross-linked polyethylene tank with 4-in. filler opening and removable drain plug. Its 5-g.p.m. centrifugal pump develops 60 p.s.i. Other features include a 3-hp. engine, bypass agitation, 15 ft. of hose, push handle, parking stand, and rib-type tires.

The 30-gal. Model D003 has a high-density, cross-linked polyethylene tank and positive displacement pump capable of producing 3 g.p.m. at 300 p.s.i. Other equipment includes a relief valve, mechanical agitation, adjustable spray gun with trigger shutoff, 25 ft. of hose, a tow-bar, and push handle. A 5-ft. spray boom is optional.

Circle 711 on free information card

Lightweight yet strong, Spee-D-Tuff grate from National Diversified Sales, Inc., is 12-inches square of



ABS plastic. A standard brick or cement catch basin is not required.

The corrosion- and rust-proof gate installs quickly with fast-drying plastic solvent. Bottom-housing screws stop vandals. It adapts to 8-inch pipe and standard 8-inch tees,

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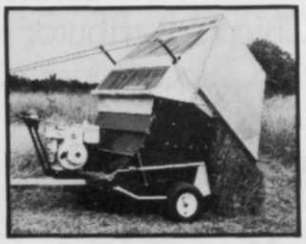

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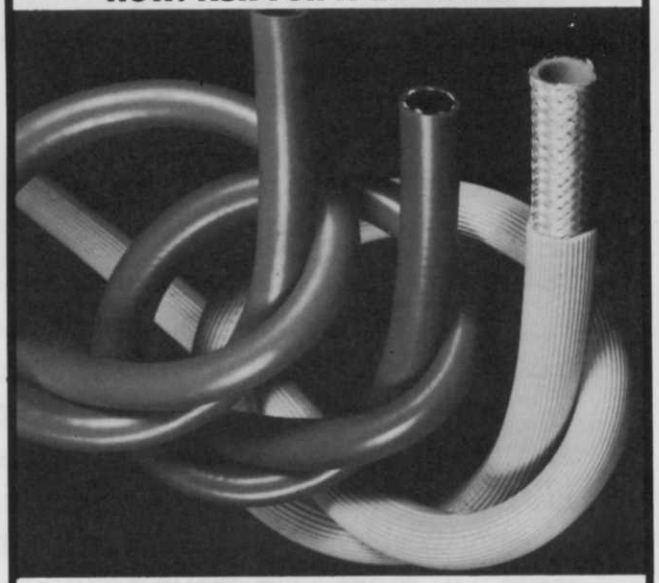

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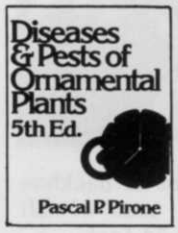

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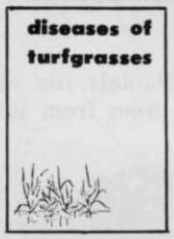

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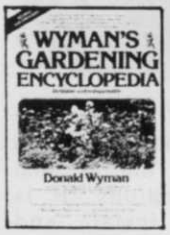

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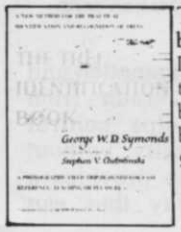

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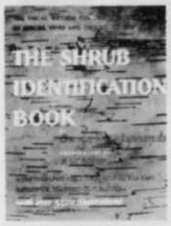

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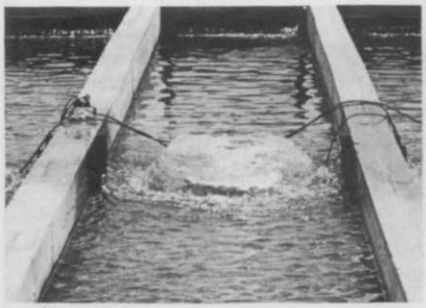
Advanced Drainage Systems, Inc. has available 10, 12, 15, and 18-inch diameter corrugated polyethylene plastic drainage tubing for athletic fields, landscaped areas, and for use

as mains and effluent run-off. The 10, 12, and 15 inch diameters come in 20-foot lengths while the 18 inch comes in 30-foot sections. It is lightweight, easy to install, and strong enough to bear heavy loads.

Circle 711 on free information card

Through continuous oxygenation and mixing, the LSS-100 aerator from Rodale Resources helps control algae and odors naturally, without toxic chemicals. It also provides a sparkling spray display that can



enhance the beauty of a small pond.

A 1/20-horsepower motor operates in only 18 inches of water. For installation, simply position the aerator in a pond, then moor or anchor it in place. It comes with 25 feet of underwater power cable and is ready to run when unpacked.

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Ford Motor Co.'s 755 tractor-loader-backhoe, 8½ tons and 91 horsepower, offers 6¾ tons of loader

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Massey-Ferguson has introduced a wide variety of implements for its line of two- and four-wheel-drive compact tractors, the MF205, 205-4, 210, 210-4, 220, and 220-4.

Included are mid-mount and rear-mount mowers, a rotary cutter,

flail mowers, two sickle bar mowers, and two rotary tillers.

One-bottom and two-bottom plows, disc harrows, rear-mounted landscape rakes, row-crop cultivators, planters, box scrapers, a post hole digger, and a front-end loader are also available.

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A complete, organic, nitrogen fertilizer, Arbor-Green supplies nutrients to shrubs and trees for a full two years. Liquid application of the 30-10-7 formula promotes strong, healthy root systems. The Davey Tree Expert Co. makes it with no nitrates or chlorides.

Arbor-Green releases slowly because of its fine powder form that

becomes a suspension rather than a solution when mixed with water. When in suspension, it will not leach away, but remains in the soil, releasing nutrients as needed. It can help develop newly transplanted shrubs and trees

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TreeGARD by Ross Daniels, Inc. expands as it protects trees from sun

scald and animal damage. The vinyl guards extend to 36-in. from the soil line and come packed 200 per case.

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Scaldis, a hard fescue with plant variety protection, has proven in test over a wide range of conditions to produce a quality turf of good persistence. The Agricultural Service Corp. product has a very dark blue-green color with excellent long-term

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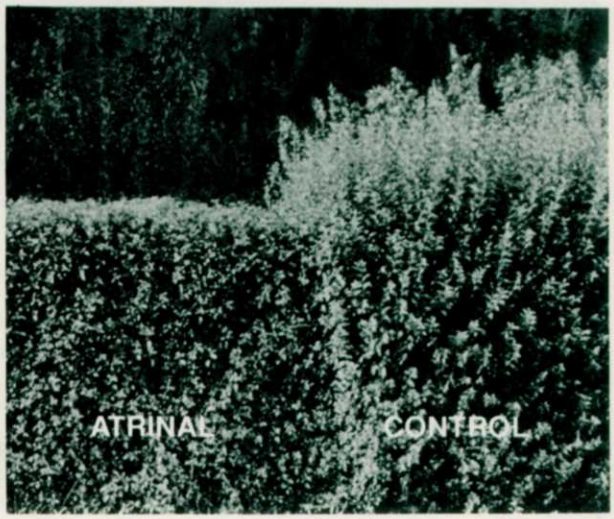

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LANDSCAPE SALESMAN WANTED: An experienced super salesman wanted, with a background in landscape sales and knowledge of plant material. Responsibilities include negotiating with architects, developers and contractors to secure landscape construction contracts. Salary and/or commission plus company benefits. If you are ambitious, self-motivated and a knowledgeable individual who enjoys a challenge and takes pride in accomplishments, you are what we are looking for. Please contact our office immediately. Bob's Green Thumb Landscaping Co., Inc., R.R. 1, Box 131, Mundelein, IL 60060. 312 634-9300.

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TURFGRASS AND LANDSCAPE MANAGEMENT: Obtain the expertise to start and/or manage a landscaping or lawn care business. For information contact: The Institute of Applied Agriculture, University of Maryland, College Park, MD 20742, 301 454-3938.

LEADING commercial flail mower manufacturer has job openings for direct factory Territory Managers. Travel for sales and service with demonstration promotion required. Salary, profit sharing, car and travel expenses. Send resume to: Box 238, Weeds, Trees and Turf, Box 6951, Cleveland, Ohio 44101.

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BUSINESS OPPORTUNITIES

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LEARN LANDSCAPING and the growing of plants at home. Start a satisfying business or hobby. Free booklet. Lifetime Career Schools, Dept. A-823, 2251 Barry Avenue, Los Angeles, Ca. 90064.

VAIL, COLORADO — Nursery and Landscape Contracting Company for sale. Year around business with snow plowing in winter. Inventory includes 7 trucks and 2 loaders. Very growing business in very growing area. Phone 303 476-3047 ask for Bob.

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WANTED: Used older truck and hydraulic loader, good condition. 303 623-2658.

ASPLUNDH BUCKET truck w/dump. Contact: Dover Tree Experts, 2191 George St., Dover, PA 17315. 717 292-6566.

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EVENTS

The current issue of WEEDS TREES & TURF carries meeting dates beginning with the following month. To insure that your event is included, please forward it, 90 days in advance, to: WEEDS TREES & TURF Events, 9800 Detroit Ave., Cleveland, OH 44102.

Maine Arborists Association annual meeting, Bowdoin College, Brunswick, ME, **Mar. 15.** Contact Anne R. Dick, Secretary, Maine Arborists Association, 227 Park Ave., Portland, ME 04102, 207/773-2921.

National Lawn Care Business Conference and Trade Show, Red Carpet Hotel, Milwaukee, WI, **Mar. 16-19.** Contact Lawn Care Conference, Box 1936, Appleton, WI 54913, 414/733-2301.

Rocky Mountain International Society of Arboriculture Workshop on Urban Forestry and Shade Tree Evaluations, Raintree Inn, Colorado Springs, CO, **Mar. 17-19.** Contact Ron Morrow, City Forester, 1400 Glen Avenue, Colorado Springs, CO 80905, 303/471-6640.

1980 International World of Pumps Show, MGM Grand Hotel, Reno, NV, **Mar. 25-27.** Contact World of Pumps, 622 6th Ave. West, Seattle, WA 98119, 206/284-6176.

"Adequate Reclamation of Mined Lands?—A Symposium," Billings, MT, **Mar. 26-27.** Contact Chris Cull, West Engineering Co., P.O. Box 67, Coalstrip, MT 59323.

Landscape Industry Show of the California Landscape Contractors Association, Long Beach Convention Center, Long Beach, CA, **Apr. 3-4.** Contact Robyn Casey, CLCA Landscape Industry Show, 3617 W. MacArthur Blvd. 500, Santa Ana, CA 92704, 714/979-2522.

Tree Care—Urban Forestry Foreman Training, Kent, OH, **Apr. 7-18; June 2-13;** and **Sept. 15-26.** Contact Richard E. Abbott, Davey Environmental Services, 117 South Water Street, Kent, OH 44240, 216/673-9511.

Southern California Turf & Landscape Annual Institute, Anaheim Convention Center, Anaheim, CA, **Apr. 8-9.** Contact Ed McNeill, Executive Secretary, Southern California Turfgrass Council, 1000 Concha St., Altadena, CA 91001, 213/798-1715.

Garden Symposium, Williamsburg, VA, **Apr. 13-16.** Contact Mrs. Peggy W. Sabol, Registrar, The Colonial Williamsburg Foundation, Williamsburg, VA 23185, 804/229-1000.

EPA Conference on Waste-to-Energy Technology Update, 1980, Cincinnati, OH, **Apr. 15-16.** Contact Ruth Anne Gibson, Battelle's Columbus Laboratories, 505 King Ave., Columbus, OH 43201, 614/424-5532.

New Jersey Recreation and Park Association Annual Conference, Golden Eagle Inn, Cape May, NJ, **Apr.27-29.** Contact Gary J. Forbes, President, 530 Turnpike, Pompton Plains, NJ 07444

Les Floralies Internationales de Montreal, May 17-29. Contact Les Floralies Internationales de Montreal, Dommissiare General, 360 Rue St-Jacques, Suite 310, Montreal, Quebec, Canada, H2Y 1P5.

Kentucky Cemetery Association Annual Meeting, Executive Inn, Louisville, KY, **June 12-14.** Contact Lewis C. Tingley, Resthaven Memorial Park, P.O. Box 18066, Louisville, KY 40218, 502/491-5950.

NRPA National Forum for Board/Commission Members, Bettendorf, IA, **June 12-15.** Contact Ted Flickinger, NRPA, 600 E. Algonquin Rd., Des Plaines, IL 60016, 312/297-6260.

Residential Landscape Design Course I, Milwaukee, WI, **June 18-20.** Contact John Shaw, Executive Director, ALCA, 1750 Old Meadow Rd., McLean, VA 22101, 703/893-5440.

Metropolitan Tree Improvement Alliance papers on "Urban Trees and Their Soils," Rutgers University, New Brunswick, NJ, **June 18-20.** Contact Dr. David F. Karnosky, Cary Arboretum, Box AB, Millbrook, NY 12545, 914/677-5343.

Residential Landscape Design Course I, Tucson, AZ, **June 23-25.** Contact John Shaw, Executive Director, ALCA, 1750 Old Meadow Rd., McLean, VA 22101, 703/893-5440.

Residential Landscape Design Course II, Phoenix, AZ, **June 26-28.** Contact John Shaw, Executive Director, ALCA, 1750 Old Meadow Rd., McLean, VA 22101, 703/893-5440.

Niagara Falls Convention & Trade Show, Niagara Falls Convention Center, Niagara Falls, NY, **June 30-July 3.** Contact Margaret Herbst, Executive Secretary, NY State Nurserymen's Assn., Inc., 101 Park Ave., New York, NY 10017.

American Association of Nurserymen's 105th Annual Convention and Trade Show, Radisson Muehlebach Hotel, Kansas City, MO, **July 13-16.** Contact Harry C. Kiely, Administrator, American Association of Nurserymen, Inc., 230 Southern Building, 15th & H Streets, N.W., Washington, DC 20005, 202/737-4060.

Aquatic Plant Management Society annual meeting, Sarasota Hyatt House, Sarasota, FL, **July 13-16.** Contact International Plant Protection Center, Oregon State University, Corvallis, OR 97331.

American Sod Producers Association summer convention & field days, Four Season Hotel, Alberta, Canada, **July 20-22.** Contact ASPA, Bob Garey, Executive Director, 9th & Minnesota, Hastings, NE 68901, 402/463-4683.

Penn Allied Nursery Trade Show, Hershey Convention Center, Hershey, PA, **July 29-31.** Contact S. Howard Davis, Executive Director, Pennsylvania Nurserymen's Assn., 234 State St., Harrisburg, PA 17101, 717/238-1673.

Southern Nurserymen's Trade Show, Atlanta Convention Center, Atlanta, GA, **Aug. 2-6.** Contact Tommy Henegar, Southern Nurserymen's Assn., 3813 Hillsboro Rd., Nashville, TN 37215, 615/383-5674.

Lawn, Garden Outdoor Living, Div. National Hardware Show, McCormick Place, Chicago, IL, **Aug. 13-16.** Contact National Hardware Show, Charles Snitow, 331 Madison Ave., New York, NY 10017, 212/682-4802.

Tan-Misslark Trade Show, Astro Hall, Houston, TX, **Aug. 16-19.** Contact Bill Fullingim, Texas Assn. of Nurserymen, 512 E. Riverside Dr., Austin, TX 78704, 512/444-7489.

Farwest Nursery Garden & Supply Show, Seattle Center Coliseum, Seattle, WA, **Aug. 24-26.** Contact Dan Barnhart, Farwest Nursery Show, 224 S.W. Hamilton St., Portland, OR 97201, 503/221-1182.

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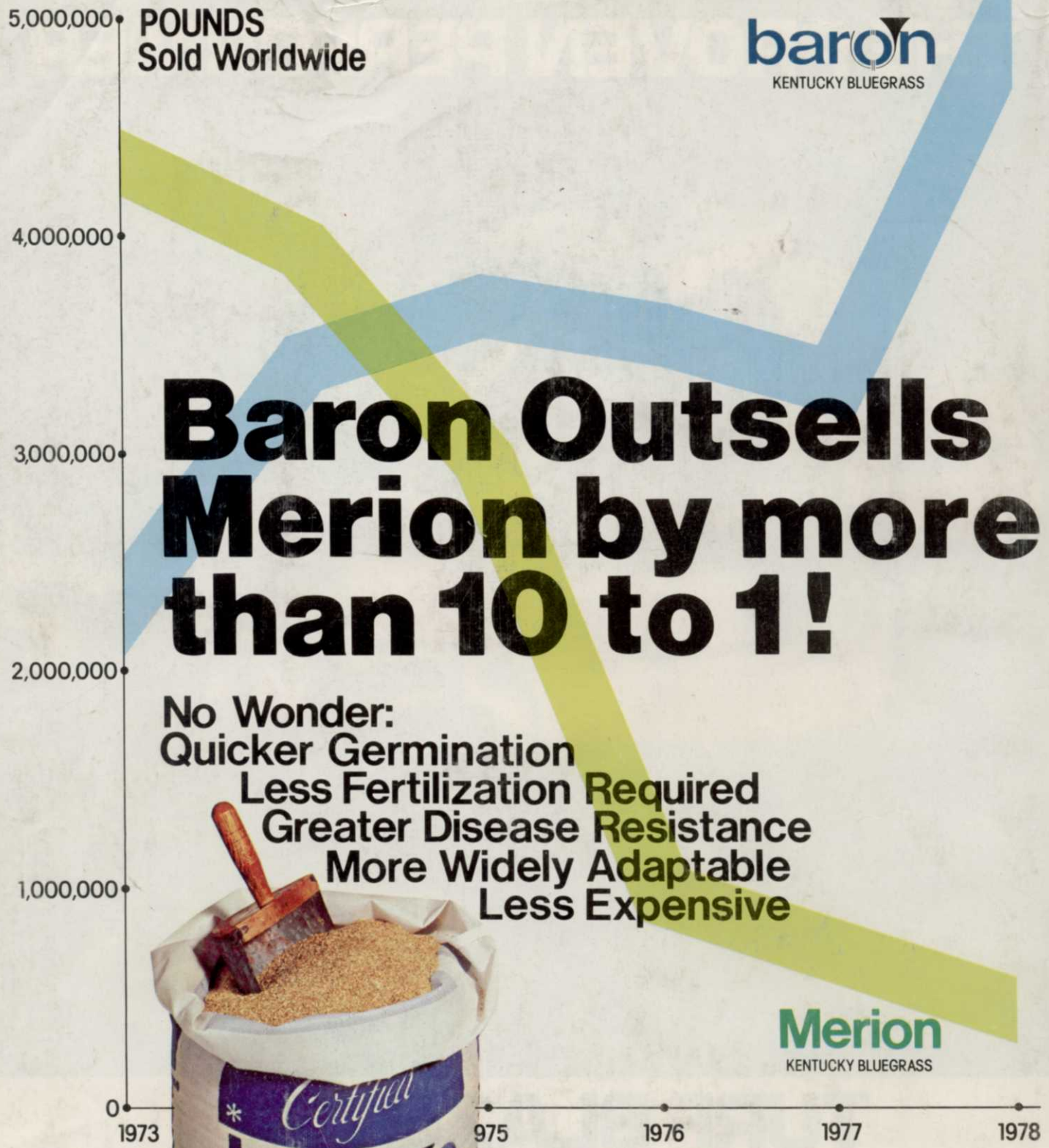

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